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The effects of specificity and position of written instructional objectives on learning from a lecture.

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THE EFFECTS OF SPECIFICITY AND POSITION OF WRITTEN INSTRUCTIONAL OBJECTIVES ON LEARNING FROM A LECTURE

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To my Father - Because all the effort I have put in this work is only a fraction of his efforts to instill in me desires for honesty, competence and perseverance.

To My Father

ABSTRACT

The Effects of Specificity and Position of Written Instructional Objectives on Learning From a Lecture (April, 1975)

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The effects of specificity and position of written instructional objectives on learning from an audiotaped lecture were investigated in this research. Previous studies reviewing the effects of adjunct questions and instructional objectives have indicated that objectives and questions placed before the passage of text increased objective-relevant (intentional) learning. Questions and objectives placed after the material resulted in increased intentional and incidental learning. While a few studies of adjunct questions considered learning from a lecture, no studies had examined the effects of objectives on learning from a lecture. The present study used materials previously used by Rothkopf and Kaplan (1972). The materials included a 54 sentence text entitled "Computer Development in the Bell Telephone System," 12 general objectives (related to 2-5 text sentences), 33 specific objectives (related to one text sentence) and a 52-item final criterion test. Subjects received specific or general objectives before or after the sections of the lecture. A control group received no objectives. One

hundred sixty undergraduate psychology students participated in the experiment. Each subject was randomly assigned to one of the five experimental groups.

Vocabulary items were used as filler tasks throughout the experiment. Correlations of vocabulary scores with incidental, intentional and total learning scores were significant and warranted the use of vocabulary score as a covariate. Multivariate analysis of covariance produced a significant effect due to position of objective favoring the groups receiving objectives before the text. In addition, position resulted in significantly different intentional learning for the treatment groups. Univariate analysis of variance indicated that incidental learning was significantly higher than intentional for the treatment groups combined.

Differing results were found when the instructional text material was presented by audiotape compared to presentation by written text. Three major differences are inherent in presenting the material by lecture. They are, that the audiotape presentation is linear, with a constant rate of flow of material. This implies that the tape does not repeat the content and cannot be stopped for the subjects to obtain additional time to process what they are hearing. Consequently, as opposed to written text, information relating to the objectives and the text must be stored in memory throughout the experiment. The significantly higher incidental than intentional learning was attributed to the audiotaped

presentation of material. There is some evidence from previous studies that changing the mode of presentation in this way, might provide for this result. The enhanced performance by the Before groups may be due to their being instructed to attend only to objective-relevant content. Since the After groups were told to learn all the material in the lecture, they were attending to about one-third more material than the Before groups. In addition, they were attempting to hold all the content in memory in order to match objective-relevant content to the objectives which they received after the lecture sections. The Before groups were holding the objectives in memory in order to match the content with the objectives. It would seem that the tasks required of the After groups were substantially more difficult than those required of the Before groups and this difference may account for the differing performances in intentional learning.

Recommendations for further research include replicating this study with a parallel group receiving the text in written form. This may provide more information for determining where differences in performance are based. Also, running subjects individually allowing them to monitor their own progress through the experiment will provide for different learning rates of the subjects.

Although the results of this study are not entirely those that were predicted they do present several possible questions about the effects of objectives on learning from a

lecture and the strategies required to process information in this way.

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CHAPTER I

INTRODUCTION

Approximately a decade ago, Ernst Rothkopf initiated a research area which had as its goal the improvement of student learning from written instructional materials. The basic notion involved in this line of research was that if researchers could develop procedures which would influence the way in which students approached, attended to, and processed instructional materials, then learning from those materials could be greatly enhanced. Rothkopf coined the term "mathemagenic activities" to describe those activities which influence student learning. He has further defined mathemagenic activities as "those student activities that are relevant to the achievement of specified instructional objectives in specified situations or places" (Rothkopf, 1970, p. 327).

Mathemagenic activities can have either positive or negative effects with regard to facilitating or interfering with learning. They have been classified by Rothkopf as follows:

Class I; Orientation: Gross Motor Activities

a. getting the subject in the vicinity of the learning situation.

b. keeping the subject in the vicinity of the learning situation.

Class II; Object Acquisition

a. selection of appropriate instructional objects.

b. procurement of appropriate instructional objects.

c. maintenance of appropriate instructional objects.

Class III; Translation and Processing

a. scanning and systematic eye fixations on the instructional object.

b. translation into speech of internal representations.

Class I and II mathemagenic activities in this classification scheme have been shown to be controllable through behavior modification techniques. Rothkopf and his associates, and those who have followed his lead, have concentrated their research efforts on developing procedures for controlling Class III activities. The initial studies in this area focused on the effects of inserting test questions at various points in written instructional materials. More recent studies have examined the impact of providing students with learning objectives relevant to the material they are studying.

The ultimate goal of this line of research is to develop procedures which will lead to enhanced student learning in actual educational settings. However, to date, there has

been very little research which shows that the procedures which have been developed have practical utility. That is, the studies have been conducted in carefully controlled classroom settings which involve artificial constraints on the presentation of learning materials, controlled inspection of the materials and a lack of uninterrupted study time. Needless to say, these are not features common to most classroom settings.

Proposed Research

At this point a brief overview of the proposed research will be presented. This will include a statement of the purposes of the study and predictions of the results. A detailed justification of the study follows the literature review and discusses more comprehensively the evolution of the study. The predictions of the results of the experiment also appear at that point.

The primary intent of the research reported in this dissertation is to examine procedures which have been developed to enhance student learning using a mode of presentation which has not been represented in previous studies. More specifically, this study will present the materials to be learned in a lecture format. The objectives will be presented in written text. This represents a departure from previous studies in that past studies have almost uniformly presented learning materials in a written format. Given that

the outcomes of the study are in accordance with predictions, the generalizability of the body of research as a whole will have been expanded. Procedures which have been shown to enhance the learning of written materials will also have been shown to facilitate learning from oral presentations. And, of course, oral presentations are a very common source of information transmission in actual classroom settings.

In addition, this research will determine the effects of specificity and position of objectives on learning. Two levels of specificity (specific, general) and two levels of position (before text, after text) were the independent variables. Two types of learning were the dependent variables. Intentional learning is the learning of objective-relevant material, while incidental learning is the learning of objective-nonrelevant material.

Subjects were nested in specificity and position, and crossed in learning. The factors of position, specificity and learning were fixed effects variables, while subjects was a random variable.

The results are predicted to show that the subjects receiving objectives would perform better than the Control group on the criterion measure. Within the objectives groups, specific objectives should enhance learning more than the general objectives. Subjects receiving objectives after the relevant text should perform better than subjects receiving objectives prior to the text. Finally, intentional

learning should be significantly greater than incidental learning.

CHAPTER II

LITERATURE REVIEW

Introduction

Research related to the problem described will be discussed in the following sections. First, a review of the prominent research on the effects of interspersed questions will be presented. This review will provide some background to this area of research and the development of the investigation of the effects of interspersed questions on learning. This development includes determining the critical variables related to questions that cause significant effects on learning. In addition, the mode of presentation of material was altered from written text in some studies to lecture presentation in others.

Researchers then began examining the effects of instructional objectives to determine if objectives had the same effects on learning as did adjunct questions. The second section of the literature review will examine the relevant research studies on the effects of instructional objectives. The development of this area of research includes the investigation of several factors similar to those which were important in the question studies. With regard to mode of presentation, the effects of instructional objectives on learning have been studied when the mode of presentation was

either written text or videotape. No research has used an audiotaped presentation of material.

Following the literature reviews of the relevant studies concerning the effects of adjunct questions and instructional objectives, a brief section will discuss the similarities in results between these two lines of research.

Review of Question Literature

The study to be presented in this dissertation evolved from a series of research studies which were concerned with enhancing student learning from written instructional materials. The initial studies conducted in this area were designed to determine if embedding questions in text would improve learning from the materials. For example, Hershberger (1964) and Hershberger and Terry (1965) had reported studies which examined the effect of presenting questions to students after they had finished reading a relevant segment of text.

Shortly thereafter, Rothkopf (1966) conducted a study in which the issue of primary concern was the point (position) at which students encountered the questions. Rothkopf also examined the effects of questions (vs. no questions) and the effects of providing answers to the questions after the subject's response. Thus, the groups in the study were: 1) SBA; questions with answers shortly before the relevant text; 2) SB; questions without answers shortly before the relevant

text; 3) LBA; all questions with answers given before entire text; 4) SAA; all questions with answers given shortly before the relevant text; 5) SA; all questions without answers given shortly after the relevant text; 6) C (control group); no questions used; 7) DRG (directed reading group); no questions used but subjects were instructed to read slowly and carefully.

The criterion test, which contained 39 completion type items, was designed to measure two types of learning. The first kind which Rothkopf called "intentional learning," consisted of the learning of material that was tested by the embedded questions. Thus, 14 of the final test items included in the criterion test were identical to those questions the subjects (who received embedded questions) had seen while reading the text. The second kind of learning, which Rothkopf called "incidental learning," consisted of the learning of material not tested by the embedded questions. There were 25 items testing incidental learning on the general criterion test.

Before conducting the major experiment, Rothkopf showed that knowledge of the answers to the embedded intentional questions would not aid subjects in responding to the incidental questions on the general criterion test. A Transfer Evaluation (TE) group responded to a form of the general criterion test and then studied the 14 adjunct questions until they demonstrated that they could correctly respond to all

questions. They then took a parallel form of the general criterion test. The results showed no differences in performance on the pre and post general criterion tests even after mastery of the facilitative questions. Thus, there was no transfer from the intentional to incidental questions.

The SBA, SB and LBA groups received instructions that the adjunct questions were samples of the kinds of questions which they would be asked on the final test. They were also instructed to guess the answers if they were not certain. In the SBA and LBA groups, subjects received the correct response immediately. In the SAA and SA groups, subjects received instructions that the adjunct questions were samples of final questions and that the questions would provide the subject with immediate feedback about how much he was learning from the passage he had just completed.

The results of the experiment showed that (as would be expected) groups which received questions while reading the text performed better on intentional questions than did the groups which did not receive questions. More interesting, however, were the effects on incidental learning. There, groups which received the questions <u>after</u> reading the relevant text sections (i.e., SA and SAA groups) performed better than all of the remaining groups except the DRG group. In other words, question position was not significant for intentional learning while incidental learning was significantly enhanced by post questions.

Rothkopf interpreted the results of this study as indicating that questions act to shape inspection of subsequent sections of text. This can be called a forward effect of post questions. When the subject encounters questions that he can answer, he will maintain his strategies for inspecting further material. If he is not successful in responding to the questions, he will modify his inspection strategies until he has developed a satisfactory one.

Frase (1967) extended Rothkopf's results of the effects of question position on learning. Using a passage half as long (2,000 words) as Rothkopf's (5,200 words), Frase measured effects on intentional and incidental learning as a function of varying lengths of passage segments, position of questions, and knowledge of question answers.

In addition to differences in total passage length, the content and type of adjunct questions (multiple-choice) used by Frase also differed from those used by Rothkopf. Frase found that question position, knowledge of results and length of passage all had significant main effects for intentional learning. Post questions increased intentional and incidental learning. Also, post questions were more effective for intentional learning when knowledge of results of answers was not provided. Passage length and knowledge of results were not significant for incidental learning.

At this point, it was known that adjunct questions facilitated learning by providing some direct instructive

effects (on intentional learning) and by causing some shaping of inspection behaviors (Rothkopf, 1966; Rothkopf and Coke, 1963). Rothkopf and Bisbicos (1967) conducted a study to determine if the learning of particular kinds of information could be enhanced through the use of embedded questions. Using materials similar to those used in the Rothkopf (1966) study, they constructed embedded questions which required particular kinds of answers (i.e., common phrases, technical phrases, measures or quantities, proper names). In addition to varying the type of information required to answer the embedded questions, Rothkopf and Bisbicos (1967) also varied the position of the question (before or after the relevant text). As was the case in the previous studies, questions placed after the relevant text proved superior to questions placed before the relevant text. In addition, subjects receiving questions calling for a particular kind of answer (i.e., proper name) did better on incidental questions calling for the same category of information. And finally, because the facilitating effects of post questions increased as the subjects progressed through the material, Rothkopf suggested that this was further evidence for the forward shaping hypothesis.

The results concerning the effectiveness of post questions for enhancing learning have been consistently established in the previous studies. Frase (1968) expanded this research by varying types of pre questions as aids for

learning passage content. Specific, comparative and general questions were examined with regard to their effects on performance on a specific information criterion test. Frase predicted that the amount of processing required for general questions would be much greater than the specific or comparative questions because each general question was related to considerable information in the passage. Hence, general questions were predicted to produce the greatest retention and learning if the subjects could see the questions before and during his viewing of the passage.

The results showed that subjects receiving specific adjunct questions performed significantly better on the criterion test than did the other two question groups. This indicates that specific questions were most effective for learning specific information. The comparative questions followed the specific questions in performance. The order of performance was the same for the results from the overall final test. Unfortunately, no measure of general information was included in the criterion test. Consequently, the facilitating effects of these three types of questions on learning general information could not be assessed.

In a study similar to the previously discussed Frase studies, Bruning (1968) studied the effects of fill-in questions vs. statement type items on relevant learning. All items and questions were presented to the subjects after the appropriate segment of the test. Subjects receiving fill-in

questions viewed the correct answer after their response to each question. In addition, Bruning paired both types of adjunct items with corresponding items containing irrelevant information. The groups working with the relevant adjunct items (fill-in questions or statements of review) performed better on the criterion test than the groups given the irrelevant questions. Questions were more facilitative than statement items. An interesting result was that the fill-in question showed increased learning over the statement item when the questions contained content relevant or content irrelevant information. This indicates some additive effect of review (from content related questions) and testing (from fill-in adjunct questions) on performance. This is supported by the significantly higher performance of the CRT (criterion relevant fill-in question) group.

Frase (1968a) investigated the effects of several question variables on intentional and incidental learning. He varied question position (before or after text segments), question pacing (every 10, 20, 40 or 50 sentences) and location of question relevant content (located in the first or second part of each 10-sentence paragraph). In addition, Frase varied the question mode he had used in previous studies (multiple-choice) and the response mode Bruning (1968) found most facilitative (fill-in constructed response). Frase used the same materials as he had in his 1967 study.

The results showed, as in previous studies, that post questions facilitated intentional and incidental learning more than pre questions. Intentional learning was significantly higher than incidental. Question position and question pacing interacted showing that increased frequency of questions enhanced learning in post question groups and interfered with learning in pre question groups. Content location interacted with type of learning such that higher intentional learning was observed if the incidental material followed the relevant material. Since question location and content location did not interact it was determined that proximity of question to related material was not a critical variable.

Frase (1968) introduced the notion of considering amount of processing required by a particular question type. This factor was investigated by Watts and Anderson (1971). They predicted that an application-type adjunct question presented to a subject would require more cognitive processing of the information in the text than a factual-type question and would therefore result in greater learning. Subjects received either factual-type questions or application-type questions after the appropriate text material. The predictions were confirmed in that application-type questions resulted in significantly greater learning than that produced by factual-type questions. The forward shaping hypothesis discussed by Rothkopf in previous studies was contradicted by

results from this study. Subjects' performance was found to be higher at the beginning and end of the instructional material than in the middle of instruction. Had the forward shaping hypothesis been functioning in this study, the results would have shown an increase in learning after the first passage until the end of instruction. Instead, a somewhat classical serial position effect was found. Watts and Anderson suggested that rather than a forward shaping hypothesis, perhaps a backward review effect of questions could explain these results. The backward review hypothesis is an explanation of the facilitative effects of inserted questions. The function the backward review serves is to stimulate a mental review of the material preceeding the questions. Therefore, a backward review effect can be seen even after the first paragraph of material, unlike the forward shaping effect which results in increases in performance on material after the first paragraph.

Since Watts and Anderson found no increase in performance through the material, the backward review is a more appropriate explanation of results than the forward shaping hypothesis.

An investigation of these two hypotheses (forward shaping and backward review) was the primary purpose of the McGaw and Groteleuschen (1972) study, which used the same instructional materials as used by Rothkopf (1966). The McGaw and Groteleuschen study examined the effects of

questions interspersed at particular intervals, the relationship of distance between the information in the passage and the corresponding questions, and the relationship between the information tested by the interspersed questions and that tested on the final criterion test. The results showed that the facilitative effects of post questions primarily support a forward shaping hypothesis. Superior performance on pages directly following the interspersed questions indicate a resultant shaping of inspection behaviors due to the questions. Some evidence for a backward review effect was seen in increased performance on criterion items, parallel to the adjunct questions, dealing with the same section of text (but controlled for direct transfer effects). The authors suggest that the main effect of adjunct post questions is forward shaping, and that once appropriate attention is given to relevant information, a review may be provided by the post questions.

Similar to Watts and Anderson (1971), Shavelson, Berliner, Ravitch and Loeding (1974) examined different types of questions and question position. Further, the interaction of these treatment variables with individual differences was investigated. Lower order (factual) or higher order (application, synthesis) multiple-choice questions were placed before or after relevant prose material. Correct answers to the adjunct questions were provided to the subjects. In addition, five measures of individual differences were taken.

The results showed that higher order questions and questions placed after the text facilitated learning more than lower order questions and pre questions. This is consistent with the results from Watts and Anderson. Vocabulary scores interacted with treatments to the extent that subjects with high vocabulary scores would perform best with a prose passage and no adjunct questions. Subjects receiving low vocabulary scores would perform better if facilitated by higher order questions placed after the prose.

Berliner (1970) extended the results of the question literature significantly by changing the mode of presentation of the instructional material from written prose to filmed lecture. Berliner varied question pacing similar to Frase (1968a), such that subjects received either one question after 2½ minutes of lecture, two questions after 5 minutes of lecture, or six questions after 15 minutes of lecture. Two control groups that received no questions were included. One control group was instructed to take notes while the other control group was directed to pay attention to the lecture. The results indicated that the question groups and the group taking notes performed significantly better than the group told only to pay attention. A retention (one week) measure further indicated significant results favoring the group receiving one question every 2½ minutes over the group merely told to pay attention. Similar follow-up studies by Berliner

provided additional support to these findings that post questions facilitate learning from a lecture situation.

Summary of Question Studies

The results of research on using adjunct questions to facilitate learning from written text have consistently shown that questions of a factual nature preceding text increase intentional learning. In addition, the use of questions immediately following the corresponding text results in increased intentional and incidental learning. These results have been consistent with the use of text passages that contain predominantly factual information, with the use of corresponding factual fill-in test type adjunct questions.

Other results, specific to particular studies indicate; that fill-in questions increase learning more successfully than review statements (Bruning, 1968); that application-type questions are more facilitative than factual questions (Watts and Anderson, 1971); that questions corresponding to particular content areas resulted in increased learning (Rothkopf and Bisbicos, 1967); and that higher order and post questions facilitate learning over lower order and pre questions (Shavelson, Berliner, Ravitch and Loeding, 1974).

The Bruning, Watts and Anderson, and Shavelson, et al. studies are mutually supportive in that review statements, which require less cognitive processing than adjunct questions produce inferior learning. Similarly, factual (lower

order) adjunct questions which require less processing than application-type (higher order) questions result in less learning. With regard to learning from a lecture, written post questions have provided an enhanced learning situation (Berliner, 1970).

There is evidence that questions serve both forward shaping and backward review functions. While McGaw and Groteleuschen (1972) primarily supported the forward shaping hypothesis, there is insufficient evidence to determine exactly which effect is most important.

Review of Objectives Literature

Rothkopf, who systematically organized the study of mathemagenic activities, was a leader in the research on the effects of instructional objectives on learning from text. The investigations of the effects of objectives proceeded in a manner similar to the research on adjunct questions. The effect of objectives vs. no objectives was examined, and when sufficient research indicated a facilitating result, other factors were investigated. Position of objectives, type of learning, density, number of objective-relevant sentences, and objective specificity were among the factors examined as being critical to enhancing learning.

In the first of a series of studies which would incorporate the use of similar materials, Rothkopf and Kaplan (1972) studied the effects of density and specificity of

instructional objectives on learning from written text. This experiment explored the use of instructional objectives to describe the relevant instructional content to the subjects. For the purposes of this and later studies, density is defined as the proportion of sentences in the text that are relevant to at least one instructional objective.

Three passages of material containing different content, two levels of objectives (specific, general), three levels of density (20%, 40%, 60%) and two types of learning (intentional, incidental) constituted the experimental manipulations in the study. A specific objective was defined as being relevant to only one text sentence, while a general objective was relevant to the content in 2-5 text sentences. Subjects were allowed to view the objectives while they were reading the text. Subjects proceeded at their own speed throughout the experiment. When each subject felt that he had adequately learned the content, he began the test.

The results showed that intentional learning was higher than incidental and that specific objectives produced higher intentional learning than general objectives. Intentional learning decreased as density increased. Neither specificity of objectives nor density had significant effects on incidental learning. Also, main effects due to specificity and density were not significant. However, the interactions between specificity and kind of learning, and density and kind of learning were significant. That density and specificity of

objectives did not affect incidental learning was considered by Rothkopf and Kaplan to indicate that specific objectives do not interfere with the spontaneous learning of non-objective information. Both intentional and incidental learning were higher for the experimental groups than the control group. In addition, it was found that overall performance increased with the number of objectives provided.

The factor of number of objectives, along with number of relevant sentences in the text and the ratio of relevant sentences to total number all became indistinguishable under the label of density. One of the purposes of the Kaplan and Rothkopf (1974) study was to separate the effects of these factors. In Part 1 of this experiment, the variables considered were specificity, passage length, and density. Procedures were the same as in the 1972 study. The following results were observed. Higher intentional learning resulted from specific rather than general objectives. The likelihood of mastering any single given intentional item decreased with passage length and generally decreased with increase in density. Concerning incidental items, there were no significant effects due to specificity of objectives and density. However, the main effect of passage length was significant. Performance on intentional items was greater than on incidental items. The experimental groups had higher intentional and incidental performance than the control group. Although

not statistically significant, the control group incidental learning decreased with increase in passage length.

Part 2 of the Kaplan and Rothkopf (1974) study examined the effects of increases in density and the absolute number of objective-relevant text sentences on intentional learning. In other words, by varying the passage lengths and maintaining the same number of objective-relevant sentences the density level would vary. Rothkopf and Kaplan could then explore the effect of passage length (holding number of objectives constant) and the effect of numbers of objectives on performance. The experiment varied two levels of objectives, three levels of relevant sentences, three levels of passage length and two levels of learning.

The results showed that the main effect due to number of relevant sentences was significant for overall test performance. The likelihood of successful performance on a given intentional item decreased as the number of relevant sentences increased. Examining the effect of passage length by holding the number of objective-relevant sentences constant across various passage lengths, it was observed that performance on intentional items remained constant. Therefore, what was designated as "passage length effect" in Part I of this experiment was actually a correlation between density and passage length. The main effect of specificity was not significant. However, the interaction of specificity of objectives with kind of learning was significant. Specific

objectives resulted in higher intentional performance than general objectives but incidental learning was not affected by this factor. Overall intentional learning was higher than incidental. The interaction of number of relevant sentences and passage length was not significant. This indicates that the absolute number of intentional sentences, not density affected intentional performance.

In summary, the likelihood of attaining any given objective decreases as the number of relevant passage sentences increases. Increasing the absolute number of objective-relevant sentences results in decreased performance. This result is independent of passage length.

In order to extend the generalizability of the results obtained with the materials used in previous studies, Kaplan and Simmons (1974) changed the specific objectives so that they contained more information. These were called objectives with information. The specific objectives used from previous studies were called objectives without information. In this sense, Kaplan likened these objectives to questions with answers and questions without answers examined by many researchers in prose learning. In this study Kaplan examined the effects of two levels of objectives (with or without information) and two levels of position (before and after text) on intentional and incidental learning. He hypothesized that the objectives presented before the text would operate as orienting stimuli directing the learner to

relevant information in the text. Objectives presented after the text, would provide a summary/review of important material. Subjects receiving objectives before the text viewed both materials concurrently. Subjects receiving post objectives, viewed the objectives after he felt he had sufficiently examined the text. All subjects monitored their own inspection times of text and objectives and began the test at their own discretion.

Results showed that the main effects in the experiment were not significant. The interactions between location of objectives and objective information, and location of objectives and kind of learning were significant. Objectives presented after the passage resulted in increases in incidental learning, but no differences in intentional learning. The interaction of location X information content X learning was significant. This resulted from the location X objective information interaction with intentional learning and the incidental learning increase from objectives located after the passage. Objectives without information resulted in greater intentional learning when placed before the text. Objectives with information increased intentional learning when located after the text. Considering incidental learning, objectives with information resulted in greater performance when located after the passage rather than before the passage. However, objectives without information did not significantly affect incidental learning when located before

or after the passage. Of primary importance from this study are the results that for intentional learning, objectives without information were more effective before the passage, while for intentional and incidental learning objectives with information were more effective located after the text.

Kaplan (1974) explored not only specificity, density and position of objectives, but the subjects' behaviors when using the objectives. He maintained that in previous studies, intentional and incidental learning scores were indirect measures of how successfully the subjects followed the directions that they were given. One purpose of the study, then, was to "directly observe the relationship between success in using objectives as a strategy for identifying and attending to relevant text sentences and subsequent test performance" (Kaplan, 1974, p. 1). This would be done by requiring the subjects to provide an overt response (supplying key text words relevant to the objective) or a covert response (locating key text words relevant to the objective) to each objective. In addition to type of response required (overt, covert), Kaplan varied specificity of objective (specific, general), density of passage (40%, 75%), and distribution of objectives in the passage (grouped before, interspersed) to determine their effects on learning (intentional and incidental). Objectives were viewed concurrently with the text. The main effects that were significant showed that specific objectives resulted in higher test performance than general

objectives, and that intentional learning was greater than incidental learning. Intentional learning was higher with specific rather than general objectives, yet incidental learning was not significantly affected by specificity. The significant response X learning interaction showed that covert responses resulted in higher incidental learning than overt responses, while intentional learning was not significantly affected by mode of response. Intentional learning was found to be significantly higher with covert response and grouped objectives rather than interspersed objectives. However, overt response with grouped objectives increased incidental learning over interspersed objectives.

Specific and general interspersed objectives requiring overt response had lower incidental learning scores than the control group. Finally, the subjects' performance for selecting correct key words for making the overt response showed that a significant relationship existed between performance on overt responses and on the test for all objective treatment groups. In summary, overt and covert responding resulted in equal intentional learning, indicating that it was "the activity of using objectives to search the text for relevant material that was critical for facilitating intentional learning rather than the overtness of the response" (Kaplan, 1974, p. 9). Incidental learning was higher for covert responding than overt responding, indicating that

overt responding detracts substantially from the attention a subject would give to non-relevant sentences.

While the results of the previously reviewed studies are in agreement with one another concerning the effects of different factors on learning, one issue is in conflict. That is, the desirability of minimizing the lengths of passages and the number of objectives does not agree with the need (as shown in previous studies) for specific objectives to enhance learning. Specifying objectives requires that more objectives be used to cover the same amount of content as covered by significantly fewer general objectives. Therefore, Kaplan (1973) explored the use of shorter segments and fewer specific objectives by dividing 3 previously used passages and their sets of corresponding objectives, each into 3 segments. Thus, the effects on intentional and incidental learning of whole and part presentation of objectives and text, three passage lengths, specificity of objectives (general, specific) and density (60%, 40%) were examined. As in previous studies, all subjects viewed the objectives and text concurrently. In the case of part presentations, subjects viewed one-third of the objectives and text at a time. All inspection times were controlled by the subject. The results indicated that part presentation was more effective for intentional learning than whole presentation although incidental learning was not affected by this factor. Also, the main effect for passage length was significant with the shortest

passage (length 56 sentences) producing higher intentional and incidental learning than the other two passages. Main effects due to specificity or density were not significant for intentional or incidental learning. Both intentional and incidental learning with whole and part presentations were higher than the control group's performance.

Smith and Kulhavy (1974) proposed that placing adjunct rules (content specific) before a passage of relevant text should increase intentional learning while adjunct objectives (behavioral directions to learn) placed after the text should significantly increase incidental learning. Text position (before, after) and distribution of adjunct items (massed, distributed) were examined between experimental groups, while type of learning and type of adjunct item (rule, objective) were treated as within subject factors. Adjunct rules were statements which included answers to corresponding test questions. The results, which partially confirm the hypothesis, showed that intentional learning was higher than incidental. The main effect of type of adjunct item was also significant. Rules resulted in higher learning than objectives when placed either before or after the passage of text. The effects of the adjunct items were not affected by position or distribution.

Smith and Kulhavy suggest that the effect of post passage presentation of objectives or rules on incidental learning, which has been seen in other studies, did not occur

because the objectives, which were to produce this post passage effect, were precise statements of the behaviors that the subject would acquire as a result of reading. In other words, the objectives would most likely be ineffective after instruction. Not only were they not a review of critical material, but in order to facilitate learning they would require a complete recall from memory of all the information in the passage before the subject could begin to use the objective to facilitate learning.

The effects of varying position, specificity, density, knowledge of objective, distribution, whole vs. part presentation and response mode on learning have been explored in the previous studies. All studies have a common factor in that all the materials were in written text. In the following experiment Kaplan and Burgin (1974) examined the differences in learning from text vs. videotape, with or without specific objectives, using both an immediate recall and delayed recall test (1 week). Two different media were used to present the instructional materials--videotaped lecture and written text. Subjects receiving objectives and videotape were given 5 minutes prior to the lecture to review the objectives. Subjects receiving objectives and written text viewed both concurrently. Three main effects were significant. The results showed that performance for subjects receiving the text was significantly better than for those receiving the videotape presentation. The main effect from

objectives did not reach significance. Intentional learning was greater than incidental and immediate recall was greater than delayed recall. The following interactions were significant. Both intentional and incidental learning were higher for text than videotape. However, it is important to note that while intentional learning ($\bar{x}$ = .44) was much greater than incidental learning ($\bar{x}$ = .32) for text presentation these differences were minimized in the videotape presentation (intentional $\bar{x}$ = .27; incidental $\bar{x}$ = .24). Objectives resulted in greater intentional learning and greater immediate recall performance than no objectives. Finally, greater intentional learning with and without objectives was found with text than videotape. Incidental learning without objectives was greater for text than videotape. There was no difference between intentional and incidental learning for text or videotape when no objectives were presented. Incidental learning was not affected by use of objectives for videotape presentations.

All of the studies previously reviewed had one factor in common. They distinguished between the types of learning resulting from the effects of different levels of specificity, density, position, presentation, response to and distribution of objectives. The examination of intentional and incidental learning was not a concern of all studies of the effects of objectives on learning. What will follow here are brief summaries of contributing studies which examined the

effects of objectives on learning without differentiating between intentional and incidental learning.

Tiemann (1968) investigated the effects of specificity of behavioral objectives on performance in a college economics course presented by videotape. The specific behavioral objectives summarized the course content, and were similar to Kaplan & Simmons (1974) objectives with information. General objectives were similar to Kaplan & Simmons (1974) objectives without information. The first performance measure, (mid-term exam) showed no significant results due to specificity of objective. The second measure, however, taken after the completion of the course showed that specific objectives produced significantly higher learning than general objectives.

Jenkins and Deno (1971) examined the effects of type of objective (general non-behavioral, specific behavioral) and knowledge of objectives (teacher possession only, student and teacher possession, student possession only) on learning measured by a final criterion test. Neither of the main effects, nor the interaction were significant. The experimenters could explain the results by considering that the instructional materials were sufficiently explicit that the objectives were unnecessary, or that teachers and/or students did not know how to appropriately use explicit objectives.

Behavioral objectives were compared with questions and advanced organizers for effectiveness in learning both factual and comprehension material in a study by Papay (1971).

In addition, the position (before, after) and distribution (massed, distributed) of the objectives and time of measurement (pretest, retention) were varied. The results showed that both questions and advanced organizers were more effective than the behavioral objectives, which were effective only in facilitating the acquisition of factual information when located before the material.

In another study measuring the effect of objectives on knowledge, comprehension, application, and analysis, Stedman (1970) found no significant difference in performance between the specific objective group, the general objectives group and the no-objectives group. Type of learning did not interact with type of objective.

Summary of Objectives Studies

Like the results of studies on the use of adjunct questions, much of the literature on the use of objectives to facilitate learning is consistent and reliable. Those results that are predominantly reliable across all studies are that the use of objectives results in increased learning over a non-objective control group. Also, specifically phrased objectives result in greater performance than generally phrased objectives. In all studies, learning relevant to the objectives (intentional) was higher than incidental learning.

In addition to these results which were consistent across all studies, other research produced significant findings in other dimensions. For example, providing objectives to subjects before the relevant passage of material has been shown to increase intentional learning, while post objectives enhance both intentional and incidental learning (Kaplan and Simmons, 1974). Presentation of objectives in part produces higher intentional learning than whole presentation (Kaplan, 1973). Learning is greater when instructional content is presented in a written text as compared to a videotaped presentation. Intentional learning from both text and videotape was increased with the use of objectives (Kaplan and Burgin, 1974).

Although intentional learning was high with pre and post objectives, and incidental learning was high with post objectives, Kaplan and Simmons (1974) found the following optimal coordination of objectives and position for increasing learning in the experimental situation.

Objectives without information placed before the text and objectives with information placed after the text result in higher intentional and incidental learning (respectively) than any other combination of objective, position and learning. In the Jenkins and Deno (1974) study, neither type of objectives, nor knowledge of objectives significantly affected learning as measured on a criterion test. Smith and Kulhavy (1974) found that rules presented either before or

after the corresponding text segment increased learning more so than the objectives (rules were more specific and contained more content than objectives). Kaplan (1974) found no significant differences between requiring overt and covert responses from subjects with regard to intentional learning. Covert responses resulted in significantly higher incidental learning particularly in the case where objectives were interspersed through the text (as compared to grouping all objectives before the passage).

Kaplan and Rothkopf (1974) found that increasing text length resulted in decreased incidental learning. Intentional learning decreased with an increase in objective-relevant sentences, but was not affected by passage length. This indicates that the absolute number of objective-relevant sentences is a significant factor in affecting intentional learning. Since this result is relatively independent of absolute passage length, density is not the appropriate explanation for this effect as had been previously reported (Rothkopf and Kaplan, 1972).

The results of the studies reviewed above indicate that when adjunct objectives are used several factors significantly affect intentional and incidental learning from prose or tape presentation of material. These factors are position and distribution of objectives in text, specificity of objectives, response mode, mode of presentation of text material, number of passage sentences and objective-relevant sentences.

These variables have been empirically shown to affect learning, and the possibility of discovering other variables or other levels of known factors, relevant to examining learning conditions, of course still exists.

Similarities Between the Observed Effects of Questions and Objectives on Learning

Many of the results consistently found from the use of adjunct questions have also been reliably reproduced using instructional objectives. In both cases, learning is greater in groups viewing an adjunct item (objective or question) compared to learning by a control group which had no adjunct item. Intentional learning is greater than incidental in both areas of research. While pre questions and objectives tend to facilitate intentional learning, post questions and objectives increase intentional and incidental learning.

In addition to these major results, Frase (1968), and Rothkopf and Bisbicos (1967), found that frequency of interspersed questions increased learning. Kaplan (1973) supported these results by showing that interspersed objectives resulted in higher intentional learning than when objectives were massed into one presentation. However, Frase specifically found that frequent post questioning had positive effects, while frequent pre questions seemed to interfere with the subject's processing of the prose material. Kaplan (1973) found that frequent pre-objectives (which could be

reviewed simultaneously with the text) enhanced learning. No post objective group was included. Hence direct comparisons with Frase's results cannot be made. Rothkopf (1966) explained that embedding the test questions in the instructional material caused a significant increase in performance on a final criterion test, even in cases where the interspersed questions dealt with content unrelated to that on the final measure.

Kaplan (1974) found that requiring an overt response to objectives resulted in decreased incidental learning. Similarly, Frase (1967) observed a decrease in incidental learning when knowledge of results was provided to interspersed questions. This decrease in incidental learning was expected since requiring an overt response to objectives and providing answers to interspersed questions further strengthened the subject's attention to relevant material. Kaplan and Simmons (1974) investigated objectives without information and likened their effects on inspection behavior to those caused by providing subjects with unanswered questions. These objectives caused the learner to selectively search the text for the appropriate information which was not stated in the objective. In this regard pre objectives or pre questions act as orienting stimuli while post objectives or post questions produce a summary or review of the material. Again, pre questions may interfere with the acquisition of incidental information.

While these and many other results in the previously reviewed studies have findings supportive of both the effects of objectives and questions, the issue of importance is why these adjunct items can be expected to similarly enhance learning. Considering the foreward shaping hypothesis of post questions, the use of objectives may produce the same inspection behaviors on subjects. After a passage of material for which he has previously or concurrently received objectives, the subject will be aware to some extent of how fully he has mastered the relevant information. The objectives will cue him as to the important material. Objectives without information (like questions without answers) cause the subject to selectively search the text for information. He will continue to modify his strategies for securing the needed information throughout the exercises until he has developed a strategy that is satisfactory for providing him with the required information. This is the strategy he will then maintain. Objectives can also serve as backward review, particularly when objectives with relevant information follow the passage. Again, the subject reviews the material through the information provided in the objectives and may also make a mental review in which case his searches may provide him with a review of relevant and incidental information.

CHAPTER III

PROPOSED RESEARCH

Justification of Proposed Research

Research dealing with the effects on learning of adjunct questions and instructional objectives has found consistent and similar results from the use of both of these facilitators. The findings provide a substantial basis for studying additional factors and their effects on learning. The proposed research will concern instructional objectives rather than adjunct questions. Hence, effectively all references will be made to the effects of objectives and the objectives literature.

From the literature it is known that objectives should be specific enough and numerous enough to substantially facilitate learning. Furthermore, to elicit different effects on learning, position and distribution of objectives become significant variables. One purpose of this study is to investigate the effects of particular levels of specificity and position of objectives on relevant and incidental learning.

Most of the objectives research has been done while studying effects on learning from written text. The effects of objectives on learning from lecture or videotaped instruction have not been investigated as completely. Another

purpose of this study therefore is to investigate the effects of written objectives on learning from an audiotaped lecture.

Tiemann (1968) televised a college course in economics and varied the specificity of the objectives he used as facilitators. He did find that specific objectives resulted in greater performance than general objectives.

Young (1973) held the rate of presentation constant for audiotaped and written presentation of material. He found that performance did not significantly differ with the two modes of presentation. Although the present study will not vary the modes of presentation of instructional material, it is important to note the following differences inherent in the two modes of presentation.

Audiotaped presentation is 1) linear, 2) constant and 3) requires much memory storage of information. Considering each of these facts, linear flow of material simply means that the student cannot "back up" and re-read a sentence he may have missed or misunderstood. No review possibilities are available. Constant rate of presentation signifies that different listening rates of individuals cannot be accommodated. All subjects must attempt to comprehend all the material at the same rate. When subjects are not given a written copy of the audiotaped lecture and are not allowed to take notes, all information they attempt to comprehend must be stored in memory.

Predictions and Hypotheses

Considering the results from previous relevant studies and the differences inherent in audiotaped presentation of material compared to written presentation, the results of the present study are predicted as follows. Each hypothesis will be stated indicating directionality of predicted results for the groups followed by the rationale for expectation of results. Therefore, the effects of two levels of specificity (specific, general) and two positions (before, after relevant text) of written instructional objectives on two types of learning (intentional and incidental) from an audiotaped lecture should show that:

Hypothesis 1.) the treatment groups (SB, SA, GB, GA) will perform significantly better on the final criterion test than the Control group

This result would indicate a facilitative effect from the objectives for learning both intentional and incidental material greater than the Control group receiving no objectives. This result has been found in Rothkopf and Kaplan (1972), Kaplan (1973) and Kaplan and Rothkopf (1974).

Hypothesis 2.) intentional learning performances will be significantly higher than incidental learning.

The evidence from previous studies has consistently shown that learning objective-relevant (intentional) material is enhanced more than learning incidental material. The results from Kaplan and Simmons (1974), Kaplan (1974) and Rothkopf and Kaplan (1972) support this prediction.

Hypothesis 3.) specific objectives will result in significantly greater performance on the final criterion test than general objectives.

Kaplan (1974) found that specific objectives did result in greater overall performance than general objectives. In the Rothkopf and Kaplan (1972) study, specific objectives enhanced intentional learning but did not affect learning incidental material.

Hypothesis 4.) the after text position will result in significantly greater performance on the final criterion test than the before text position.

This prediction is based primarily on the effects of post questions on learning. From the previous literature review it was seen that the post text position of questions was more facilitative of learning than pre text (Frase, 1967). Examination of this hypothesis will attempt to extend the results from question studies to objectives studies. Particularly, determination of a main effect due to

position of objectives and not simply an interaction of position and learning is the focus of this prediction.

Hypothesis 5.) position of objective will interact significantly with type of learning such that the after text objectives will enhance incidental learning more than before text objectives.

Again this prediction originated in the results of question studies. Both the before and after text positions were observed to enhance intentional learning, but the after text position enhanced incidental learning as well. Kaplan and Simmons (1974) provide support for this result in terms of the effects of objectives.

Hypothesis 6.) specificity of objectives will interact significantly with type of learning such that specific objectives will enhance intentional learning more than general objectives.

Since each specific objective directly relates to one text sentence it would seem reasonable that when considering intentional learning the specific objective would be more facilitative than the corresponding general objective which relates to 2-5 text sentences. Both the Kaplan (1974) and Rothkopf and Kaplan (1972) studies indicate the interaction of specificity X learning in the direction that specific objectives do indeed produce higher intentional learning than

general objectives. Incidental learning is not affected by this factor.

Assuming that the results occur as predicted, they can be interpreted as meaning that the objectives act as orienting stimuli to provide for selective attention to the text when placed before the passage. When objectives are placed after the material, they serve as a summary and/or review of the material. Specific objectives should provide more discrimination in listening to the content than general objectives.

Objectives placed after the passage should stimulate some mental review of material. The post text position should facilitate incidental learning over the pre text position in that the review of materials is not limited by prefocused attention to specific information as is done in the before groups.

The results of this study will not have direct application or generalizability for classroom learning because none of the factors in the experimental situations simulate a classroom learning experience. It is hoped, however, that generalizable research on instructional objectives, modes of presentation of material, and other significant factors will be used to improve research based teacher training and curriculum development. Empirical investigation may indicate the most effective and efficient methods for enhancing classroom learning.

CHAPTER IV

METHOD

Introduction

This experiment was conducted under highly controlled procedures. To begin with, all treatment and control groups were run during each session, to eliminate potential differences caused by time of day, size of group, day of the week and other similar factors. The materials used were completely systematic and organized so that relatively few subjects did not follow directions. Since the lecture passage and all instructions were presented on audiotape, each group of subjects received identical instructions and stimuli throughout the session.

All inspection time of objectives, lecture and test was controlled by the experimenter.

The method section will describe all materials used in the experiment. In addition, all materials are included in the Appendices. The procedures for conducting the sessions are explained in detail. Finally, the techniques for hand-scoring the data are included.

Design and Subjects

There were five groups in the study, four of which received treatments that differed in specificity of objectives (specific, general) and the position at which the

objectives were presented (before or after the relevant material). The fifth group was a control group and received no treatment. The subjects in the first treatment group received specific objectives before the appropriate passages of material(SB) while the second treatment group received specific objectives after the material (SA). The subjects in the third treatment group received general objectives before the material (GB), and the final treatment group received general objectives after the material (GA). The Control group received no objectives with the material (C).

One-hundred eighty-four undergraduate psychology students originally participated in the experiment for extra course credit. Each subject was randomly assigned to one of the five groups. Of the original 184, 17 subjects failed to follow directions and were not included in the analysis. An additional 7 subjects were randomly dropped to equalize the number of subjects in each group. Thus, the final sample consisted of 160 subjects, 32 of which were assigned to each of the five groups. These subjects, of which 71% were female and 29% male, ranged in age from 18 years to 22 years.

Materials

The materials used in the study consisted of a prose passage entitled "Computer Development in the Bell Telephone System," a list of specific and general objectives drawn from the passage, and a 52-item criterion test which measured

learning from the passage. These materials were identical to those used in several previous studies and were obtained from segments of two textbooks from the Systems Training Department, Bell Telephone Laboratories, Piscataway, New Jersey. In addition, a vocabulary test was administered to all subjects in the experiment. This test served the dual purpose of a filler task during various points in the experiment and as a potential covariate in the data analyses.

Lecture Passage

The lecture passage used in the experiment contained 54 sentences and 1,091 words. The entire passage had a 60% density level with density being defined as the proportion of sentences in the text that were relevant to at least one instructional objective. When the lecture was prepared for audio taping, it was divided into four sub-sections based on content coherence, length of sub-section, number of specific or general objectives relevant to each sub-section, and maintenance of 60% density within each of the sub-sections. The following Table I presents the number of sentences and the density level of each of the four sub-sections.

TABLE I

PASSAGE PARAMETERS

Sub-section	# of sentences	Density level
1	18	61%
2	13	61%
3	11	63%
4	12	58%

Before preparing the lecture for presentation, prior knowledge of passage content was assessed from a small group of students similar to the intended sample. The students were asked to read the passage and underline those sentences which contained information that they had learned previously. The results showed that occasional sentences were underlined by the students throughout the passage with almost no similarity across subjects. It was determined that all of the material was new to the students, and therefore prior knowledge was not a concern. The lecture passage used in the study is presented in Appendix A.

Objectives

Thirty-three specific and twelve general objectives accompanied the lecture passage. A general objective was defined as being relevant to the content in 2-5 adjacent sentences of text material, while specific objectives were

relevant to only one sentence in the text. (In the subjects' materials the groups of objectives were called "Lists of Goals.") Each instructional objective was a single sentence or phrase which described a relevant learning outcome.

The relevance of the objectives to text sentences had previously been ascertained in a study by Rothkopf and Kaplan (1972). They asked subjects to assign given objectives to their appropriate text sentences. A sentence was considered relevant when 90% of the subjects assigned it to the same objective. When 90% agreement was not achieved, the materials were rewritten until sufficient agreement was achieved. The objectives used in the study are presented in Appendix B.

Tests

Fifty-two short answer or fill-in-the-blank questions comprised the final test. A test question was prepared for almost every sentence in the passage by rephrasing the text sentence and replacing significant words with blank lines of uniform length for student response. Of the 52 questions, 33 were relevant to both an objective and a text sentence (intentional), and 19 were relevant only to a text sentence (incidental). The questions were arranged in random order on the test. In a previous study, Kaplan and Simmons (1974) varied the order of the questions in the final test and found no significant difference in performance on the test due to question order. The test is presented in Appendix C.

Vocabulary Questions

Thirty-six multiple choice vocabulary questions of varying difficulty were administered in groups of nine to all subjects. These items were obtained from the Kit of Referenced Tests for Cognitive Factors (French, et al., 1963). An additional thirty-six questions of varying difficulty were prepared for filler material for the Control group. The distractors for these 36-vocabulary questions were obtained by administering the vocabulary words in an open-ended test to a group of students who were required to write what they thought the meaning of each word was. The incorrect responses were checked for plausibility and thereby with the correct answer became the multiple choice options for the questions. Vocabulary questions are available in Appendix D.

Timing

Before beginning the major experiment, a pilot study was run to determine the appropriate timing sequences necessary for satisfactory completion of the tasks involved in the study. Three versions of the first subsection of the passage (18 sentences) were prepared at a fast speed (2 minutes), a moderate speed (3.5 minutes) and a slow speed (5 minutes). Ninety percent of the subjects listening to the passages presented at these speeds agreed that the presentation at moderate speed was easiest to follow and provided the best

opportunity for learning. In addition, it was determined that 18 minutes was sufficient time for 90% of the pilot subjects to complete the criterion test, and 2½ minutes sufficient time to complete the experimental tasks (i.e., vocabulary questions and reading objectives).

Procedure

The materials (objectives, vocabulary questions and final test) for the experiment were organized into five different booklets corresponding to the five treatment groups in the study. The booklets were randomly assigned to the subjects when they arrived for the experiment. The cover of the booklet directed them not to open their booklets until the tape had instructed them to do so. Subjects were not aware that they would receive different treatments. Once the tape was begun, subjects arriving late were not allowed to enter the room. The tape gave a one-minute introduction instructing subjects that the tape would read four sub-sections of a lecture once only, that they would be tested after all the lecture had been read, that the time allotments for all tasks would be specified, and that the tape would direct them to the appropriate pages they should follow in their booklets. A script of the tape is found in Appendix E.

The subsequent sequence of all events and the times allotted for each task for all subjects is contained in the following Table II.

TABLE II

PROCEDURE OF EXPERIMENT

Task #	GROUPS					Time Allotted
	SB	SA	GB	GA	C	
1	Read Abstract of Lecture					½'
2	Read 11 Objectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	9 Vocab-ulary	2½'
3	Tape Reads Lecture Section #1					
4	9 Vocab-ulary	Read 11 Objectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	2½'
5	Read 8 Ob-jectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	9 Vocab-ulary	2½'
6	Tape Reads Lecture Section #2					
7	9 Vocab-ulary	Read 8 Ob-jectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	2½'
8	Read 7 Ob-jectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	9 Vocab-ulary	2½'
9	Tape Reads Lecture Section #3					
10	9 Vocab-ulary	Read 7 Ob-jectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	2½'
11	Read 7 Ob-jectives	9 Vocab-ulary	Read 3 Ob-jectives	9 Vocab-ulary	9 Vocab-ulary	2½'
12	Tape Reads Lecture Section #4					
13	Begin Rest		Begin Test		Begin Test	18'
		Read 7 Ob-jectives		Read 3 Ob-jectives		2½'
14		Begin Test		Begin Test		18'
	9 Vocab-ulary		9 Vocab-ulary		9 Vocab-ulary	2½'
15	Informational Questions -- Demographic Data					1'

The subjects were then instructed to close their booklets after completion of task 15.

The SB, GB and C groups began the test immediately after the tape finished reading Lecture Section #4 (task #12) so that there would be no time lag between contact with the content (at task 12) and beginning work on the test (at task #13). If these groups had answered the final 9 vocabulary questions after the Lecture Section #4, as they had done after the 3 previous lecture sections (at tasks #4, #7, #10), a $2\frac{1}{2}$' time lag would have been introduced that would not have been present in the SA and GA groups which were reviewing their last set of objectives (task #13) immediately after Lecture Section #4 and directly prior to beginning the test (task #14). The additional 36 vocabulary questions answered by the Control group served as filler material while the treatment groups were reading objectives. These vocabulary questions were not used in analysis.

Before the taped presentation of each section of lecture the subjects were instructed to turn to a particular blank page in their booklets (at task #3, 6, 9, 12) and to keep that page open during the passage reading. Subjects were instructed throughout the experiment not to turn to preceeding or succeeding pages in their booklets, and to continue working on the task specified on each page until the tape instructed them to stop. The five booklets are presented in Appendix F. The amount of time for inspection of objectives, text material in the lecture and the test were controlled by the experimenter and were uniform across all groups.

All subjects were instructed to answer all test questions, even if they had to guess.

Subjects who received objectives before the sections of lecture (i.e., SB, GB) were instructed to learn only the information in the lecture which was related to the objectives. The subjects who did not receive objectives before the subsections of lecture (i.e., GA, SA and C) were instructed before each lecture passage to learn everything in the material which would follow on tape. These instructions permitted testing intentional (relevant to objectives) and incidental (non-relevant) learning.

Because the booklets were bound and because different colored pages were used at different points in the experiment, it was relatively simple to monitor the subjects procedure through the experiment. Participation in the experiment took 53 minutes.

Scoring

The answer key for the vocabulary questions allows for only one correct answer per question. The answer key for the final test provides all acceptable answers for each question. No response other than those specified was accepted. Partial credit was not given on a question in which a partially correct response was given. The tests which were scored individually each yielded four scores; the number of correct vocabulary answers, the number of correct intentional

questions, the number of correct incidental questions and the total number of correct criterion test responses. Each of these numbers was converted to a percentage based on the total number of items in each of these four groups. The answer keys are presented in Appendix G.

CHAPTER V

RESULTS

Introduction

The data analyses were designed to serve several purposes. The first analysis was a series of Pearson Product Moment Correlations between the vocabulary scores and intentional, incidental and total learning scores. Correlations were computed for each experimental group and for all groups combined. The results of the correlational analyses established whether there was a sufficient relationship between vocabulary scores and learning scores to warrant an analysis of covariance.

Two multivariate analyses of covariance examined the data for main effects and interactions. A 2 (position) X 2 (specificity) multivariate analysis of covariance with intentional and incidental learning scores as dependent variables was conducted to determine if there were differences in the dependent variables due to position and specificity of objectives for the four treatment groups (SB, SA, GB, GA). A 5 X 2 (groups X learning) multivariate analysis of covariance compared all 5 groups for differences in the two types of learning.

Two univariate analyses were conducted in order to obtain comparisons not available from the multivariate analyses. The univariate 2 (position) X 2 (specificity) X 2

(learning) analysis of variance provided a test of significance for a main effect due to learning and for interactions between learning and specificity and position.

The univariate 5 (groups) X 2 (learning) analysis compared all experimental groups for differences in learning. From these results, one-tailed Dunnett tests were computed to compare each treatment group with the Control group for differences in learning performance. These tests could not be conducted from the available multivariate data.

Summary of Correlational Analyses

Pearson Product Moment Correlations were computed on individual experimental groups and on all groups combined. Vocabulary scores were correlated with scores for intentional learning, incidental learning and total learning.

The results of the combined group analyses are summarized in the following table.

TABLE III
COMBINED GROUP CORRELATIONAL ANALYSES

Vocabulary with	Correlation
intentional	.45**
incidental	.47**
total score	.51**
N = 160	Significance: * =< .05; ** =< .01

The results of these analyses indicate a significant positive relationship between vocabulary scores and the three learning measures.

The correlations between vocabulary scores and measures of learning for each experimental group are contained in the following table.

TABLE IV

INDIVIDUAL GROUP CORRELATIONAL ANALYSES

Vocabulary with	SB	SA	GB	GA	Control
intentional	.24	.56**	.41*	.75**	.54**
incidental	.61**	.55**	.34*	.57**	.38**
total score	.53**	.58**	.41*	.75**	.52**
N = 32 each group	Significance: * =< .05; ** =< .01				

It is interesting to note that the only correlation that did not reach significance was the correlation between intentional learning and vocabulary score in the SB group.

The correlations between learning scores and vocabulary in the GB group, which had the highest overall learning, were significant at the .05 level. The correlation between incidental learning and vocabulary in the Control group was significant at the .05 level. All other correlations reached significance at $p < .01$.

Since the results of the correlations of vocabulary scores with learning scores were highly significant (average r = .48), a statistical adjustment for contribution of vocabulary score to the dependent measures (learning types) is advisable (Myers, 1966, p. 348). This adjustment requires that an analysis of covariance be conducted for analyzing the experimental data. Use of the analysis of covariance eliminates a portion of the error that can be accounted for by the vocabulary measure. Hence, the analysis of covariance operates with a smaller error term and provides a more efficient and powerful test of treatment effects (Myers, 1966).

Analyses of Treatment Groups Data

A critical assumption underlying univariate analysis of variance is homogeneity of variances. This assumption must be satisfied to allow for correct analysis and interpretation of the data.

Hartley's test for homogeneity of variances (Winer, 1966, p. 93) showed that the variance of intentional learning scores differed significantly from the variance of incidental learning scores (F_{max} = 1.68, df 2/127, α = .01). Therefore, a multivariate analysis of covariance was the appropriate analysis procedure. This analysis treated intentional and incidental learning as two dependent variables. Vocabulary scores served as the covariate. From the multivariate analysis for treatment groups (SB, SA, GB, GA), the

main effects due to position and specificity of objectives were tested for both dependent variables combined. When significant, the multivariate analysis then tested each dependent variable separately for significance with a univariate analysis. (In order to distinguish this subsequent univariate analysis from the strict univariate analysis, the multivariate-univariate will be designated as univariate (m).) Interaction of position and specificity was also tested in the multivariate analysis. Interactions of position or specificity with type of learning were not available from the multivariate analysis. The main effect due to type of learning was also not available from multivariate analysis. These tests are however available from a univariate analysis of the data and will be discussed following the explanation of the multivariate analysis.

Multivariate and Univariate Analyses of Treatment Groups

The mean percentage recalled for each of the treatment groups and the Control group are presented in Table V.

TABLE V

MEANS OF LEARNING SCORES

Learning	SB	SA	GB	GA	C
intentional	36.31	31.59	39.53	34.28	27.75
incidental	37.56	36.97	40.31	38.53	29.63
Total	36.94	34.28	39.92	36.41	28.69

The results of the 2 X 2 multivariate analysis of covariance yielded the following findings for the four treatment groups (SB, SA, GB, GA). The main effect due to position of objectives was significant ($F = 5.84$, df 2/122, $p < .01$) for both dependent variables combined. In the subsequent univariate (m) analyses, position was significant for intentional learning ($F = 11.61$, df 1/123, $p < .01$) but not for incidental learning ($F = 1.06$, df 1/123, $p < .05$). This indicates that one of the two treatment positions (before or after text) differed significantly from the other across the four treatment groups for both learning variables and particularly for intentional learning. Judging from the means, the before text position ($\bar{x} = 37.92$) accounts for greater intentional performance than the after text position ($\bar{x} = 32.94$). This result is similar to a univariate position X learning interaction. Neither position enhanced incidental learning significantly. In addition, the main effect of specificity did not reach significance, indicating that neither level of specificity affected the types of learning. Finally, the interaction between specificity and position was not significant.

The data from this experiment were also analyzed by univariate methods without the covariate. (When considering this mixed design--2 between group variables, 1 within group variable--as univariate with repeated measures on the last factor, it was not possible to computer analyze these data

with an analysis of covariance.) In the univariate 2 X 2 X 2 analysis, it is interesting to note that the only main effect that reached significance was learning ($F = 7.62$, df 1/124, $p < .01$), favoring incidental learning ($\bar{x} = 38.34$) over intentional learning ($\bar{x} = 35.42$) across all treatment groups. This result has not been found in previous studies which examined the effects of objectives or questions on types of learning.

The main effect of position was not significant ($F = 2.57$, df 1/124, $p > .05$), although the position variable showed higher overall learning with before text objectives ($\bar{x} = 38.43$) than with after text objectives ($\bar{x} = 35.34$). The main effect of specificity was not significant ($F = 1.76$, df 1/124, $p > .05$), but general objectives resulted in higher overall learning than specific objectives. None of the interactions were significant, although the position X learning interaction approached significance ($F = 3.23$, df 1/124, $p < .08$).

Analyses of Treatment Groups vs. Control Group

The 5 X 2 (groups X learning) multivariate analysis of covariance compared all experimental groups (SB, SA, GB, GA, C) for differences in learning. The main group effect was significant ($F = 3.97$, df 8/306, $p < .01$). In the subsequent univariate (m) tests, it was shown that the groups differed significantly on both intentional learning ($F = 7.34$,

df 4/154, $p < .01$) and on incidental learning ($F = 3.40$, df 4/154, $p < .01$). An examination of the means suggests that the significant differences in learning across the groups is due largely to the lower intentional and incidental performances of the Control group compared to the treatment groups.

An examination of the group means shows that the differences in intentional learning are due largely to position of objective.

The corresponding 5 X 2 (groups by types of learning) univariate analysis also showed a significant main effect due to group ($F = 4.43$, df 4/155, $p < .01$). The main effect for learning was also significant ($F = 8.709$, df 1/155, $p < .01$). The significant learning effect was due to higher incidental learning ($\bar{x} = 36.60$) than intentional learning ($\bar{x} = 33.89$). The interaction of groups X types of learning was not significant.

In order to compare each treatment group to the Control group the one-tailed Dunnett test was performed on the univariate data. A comparable multivariate test was not available. Nevertheless, since the 5 X 2 univariate analysis yielded the same results as the 5 X 2 multivariate analysis, the univariate Dunnett test was sufficient for this comparison.

Using the total means for each group (Table V) the results of the Dunnett tests showed that the SB ($t = 4.02$, df 4/155, $p < .01$), GB ($t = 5.48$, df 4/155, $p < .01$) and GA

($t = 3.76$, df 4/155, $p < .01$) groups differed significantly from the Control group in overall performance. The SA group did not differ significantly from the Control group ($t = 1.101$, df 4/155, $p > .05$). In other words, from the significant main group effect, after examining Dunnett tests and examining the means, we further see that overall performance on the final criterion test was significantly greater for the SB, GB and GA groups than for the Control group.

The analysis of variance Tables are included in Appendix H. A table of all means and corresponding standard deviations appears in Appendix I.

CHAPTER VI

DISCUSSION

Discussion of Results

The results of this study did not entirely support the predictions for the experiment. Each prediction and corresponding result will be discussed separately in the following section.

Hypothesis 1 predicted that the treatment groups would perform significantly better than the Control group. From the results, the SB, GB and GA treatment groups did support this hypothesis. It has been shown then, that learning from written text and from audiotaped lecture is enhanced by the use of objectives compared to no objectives.

The prediction for the objective specificity variable was that specific objectives would enhance learning more than general objectives. As was indicated in the results section, this prediction was not confirmed.

One possible reason that this prediction was not supported has to do with the use of audiotaped presentation in this study rather than the written presentation format used in previous studies. The audiotaped presentation of materials can be considered to be linear in nature; which means that the subject had one opportunity only to obtain the content relevant to an objective. In addition, the required content for a specific objective was contained in only one

text sentence. This means that the subject had one chance while listening to the tape to match the specific objective to its single corresponding text sentence. It is apparent that this match of objective to single text sentence, during the lecture, could not be successfully completed. Therefore, specific objectives did not enhance learning more than general objectives.

The prediction regarding the main position effect favored the after text objectives for enhancing learning. This prediction was not supported by the results. In fact, the results showed that the before text objectives significantly increased learning more than the after text objectives. Since there have been no studies that have found a main effect on learning due to position of objectives, this result is not contradictory to previous findings. With regard to overall learning from an audiotaped lecture, the before position is more facilitative than the post position of objectives. This result does indicate a departure from findings on the use of adjunct questions. The before text objectives, serving as orienting stimuli for selective attention to the text, were more effective than post objectives providing a summary/review.

The significant interaction of learning and position of objective was also not consistent with previous results. Prior studies have shown that intentional learning is enhanced equally by before and after text objectives. The interaction

occurs because incidental learning increases from post objectives compared to pre objectives.

The results of the present study show that incidental learning was not affected by position of objective, but intentional learning was greatly enhanced by the use of before objectives compared to after objectives. This result may be due to the manner in which subjects in the different position treatments had to attend to the material to obtain the objective-relevant content. First, subjects in the before groups were instructed to learn only the objective-related content, while subjects in the after groups were told to learn all the content of the lecture. Assuming that subjects followed these directions, the before group subjects had to attempt to comprehend only 2/3 of the amount of material as the after group subjects. Also, because of the constant, linear audiotaped presentation, the amount of information required to be held in memory by the subject may be critical. For example, since no objective provides the subject with the answer to an intentional test item the subject must match the objective to the objective-relevant content to insure successful performance on the final test. In order to make this match, the before subjects must hold only the objectives in memory, while the after subjects must hold the entire lecture segment in memory until they can match the objective-relevant content to the objectives which follow the

passages. This difference in suggested behaviors may indicate some explanation of results.

The specificity by learning interaction which consistently occurred in previous studies, and which was predicted to occur in the present study did not reach significance. The specific objectives which should have enhanced intentional learning were shown to be less effective (although not significantly) than general objectives.

By far, the most interesting result from this study was the significant learning effect showing incidental learning higher than intentional. This result contradicts the findings in all previous studies on questions or objectives which have consistently found intentional learning higher than incidental.

There is, however, an indication of support for this result from Kaplan and Burgin (1974). In that study the difference between intentional and incidental learning decreased when the stimulus for presenting the material moved from written text to videotape. At that point, intentional learning was only slightly higher than incidental learning. One might expect then that as the stimulus moved to a totally audiotaped presentation, the incidental learning could exceed intentional learning.

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

Summary of Study

The effects of two levels of specificity and position of written instructional objectives on two types of learning from an audiotaped lecture were investigated in this study. Materials, including objectives, text and test, were the same as those used by Rothkopf and Kaplan (1972). The mode of presentation of material was changed from text to audiotape for the study. Subjects received specific or general objectives either before or after the four sections of text. The Control group received no objectives. All subjects received a test which was composed of objective-relevant and objective-irrelevant items. The results showed that incidental learning was higher than intentional learning, for all groups combined. In addition, the before position resulted in higher overall learning and higher intentional learning than the after position. Neither the main effect due to specificity nor the remaining interactions were significant.

The results were explained in terms of differences in audiotaped presentation from written text presentation, and the amount of material required to be held in memory.

According to the results of this study, many of the effects of objectives on learning from text are not supported when the text is presented by audiotape.

Limitations of the Study

Had this experiment been conducted under circumstances not limited by practicality or availability of resources the results may have been quite different indeed. The purpose of this section is not to make projections on results of the ideal experiment but to state the parameters which restricted the study.

With regard to the data collection strategy, generalizability to an instructional situation may have been enhanced if the subjects could have been taken from elementary or high school classrooms. Also, if subjects could have been run individually, the experimenter would not have had to control inspection time of the objectives or of listening to the lecture. Allowing subjects to proceed through the experiment at their own rates may have provided better opportunity to attend to the materials as anticipated. Treatment effects may then have resulted as predicted.

In the data analysis, a univariate analysis of covariance could not be conducted for comparison with the results from the multivariate analysis. Also, information needed for a multivariate equivalent to the univariate Dunnett Tests could not be provided by the University Computer.

Finally, if resources had allowed, the experimenter would have run, in addition to the present experiment, corresponding subjects in the five experimental groups who received the text of the lecture in a written passage. All

other procedures and materials would be the same as that in the actual experimental condition. The outcomes of this text group experiment would have been comparable to results from previous research studies which examined the effects of objectives on learning from text. If these results were consistent with previous studies, then the highly unpredicted results of learning from audiotape could be explained by the change in stimulus (from text to lecture). Since there was no text group run similarly to this experiment comparisons cannot be made and the explanation of results is somewhat confounded.

Recommendations for Further Research

According to the results of this study, the effects of objectives on learning from written text are not replicated when the content is presented by audiotape. Significantly different results have been seen to occur. Since this study is one of the first which has examined effects of objectives on learning from an audiotaped lecture, this area of research is relatively unexplored. From the limitations of this study many suggestions for further research can be identified.

If a study similar to this is to be run it would be advisable to run a corresponding group of subjects who receive the text from a written lecture. The results from this group will provide a basis for comparisons with other

studies and with the results of the on-going study (from the audiotaped stimulus).

With regard to procedures for running the groups receiving audiotaped stimulus, the following changes may enhance the effectiveness of the objectives. First, subjects should be allowed more time to process the information in the text which is relevant to an objective. This can be done by allowing the "before" groups to view the objectives during the lecture passages. However, if the after groups are still receiving objectives for a substantially less amount of time, results may be confounded. That is, if the before group performs significantly better than the after group, one cannot immediately deduce if the effect is from position or from the prolonged amount of time that they viewed objectives or an interaction of these factors.

Another possible procedure could be to allow subjects an allotted amount of time to think about the lecture and objectives after the groups have received both. In this way, the amount of inspection times for all groups will be controlled.

One method which would approximate a real situation more closely, but would be difficult to implement, would be to run subjects individually, allowing each to monitor his own progress through the lecture. Here, linearity of presentation and the constant flow of material would be eliminated in favor of individual learning styles.

Finally, the use of a different type of instructional passage may produce different learning results. Learning of content that was more academically oriented or not of such a highly factual nature may be enhanced differently by the use of objectives.

As suggested, this area of research on learning from a lecture aided by instructional objectives is not greatly explored. The possibilities exist for investigation of critical variables similar to those affecting learning from written text aided by objectives or questions.

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APPENDICES

APPENDIX A

Experimental Lecture Passage

Computer Development in the Bell Telephone System

Lecture Section #1

Data processing in the telephone industry was on a manual basis prior to 1945. Accounting people used addressograph plates, calculators, and bookkeeping machines to accomplish the task of customer billing. There was even some use made of punched cards known originally as Hollerith cards. Equipment used to sort and summarize these cards operated electromechanically. Punched cards found practical application in such areas as the maintenance of property records and cost accounting.

The technological impetus of World War II brought into being a new line of electromechanical machinery capable of processing punched cards faster and more accurately than was previously possible. Moreover, this electric accounting machinery could now multiply, divide, add, subtract, sort, summarize, and print results, using one integrated line of equipment.

An Automated Message Accounting (AMA) system was adopted by the Operating Telephone Companies shortly after World War II. This system used an electromechanical line of equipment and paper tape to process local and long distance calling information for billing purposes. The AMA system developed at Bell Laboratories found widespread use throughout the Bell

System and it became one of the forerunners of the modern electronic computer system.

First generation, large-scale digital computers for business applications made their first appearance between 1945 and 1954. The first generation of computers used banks of vacuum tubes. In comparison with today's machines, they were large and slow, consumed enormous amounts of power, and were very inefficient.

The memory of these early computers was contained on vacuum tubes and stored on paper tape and magnetic tape. This meant that data could not be accessed directly or in a random manner. It had to be processed and retrieved sequentially or serially in the same manner that it was originally stored on the tapes. Because the memory was on paper and magnetic tape, "batch" processing was required as the mode of operation. Batch processing in early computers required that work of a similar nature must first be collected by type, brought to the machine, processed, and the results than taken away.

Lecture Section #2

Mark sensing, marking letters and digits by pencil strokes on a blank punched card, was also a post World War II development. These pencil strokes could be "read" mechically, and subsequently punched into the card, which was then ready for processing.

Developmental work aimed at creating an accounting system was performed by selected Operating Companies under the traditional guidance of the AT & T Co. By 1954 such a system had been developed and was made available to all Bell System Operating Companies. Following the development of the accounting system, the application of electronic accounting machines was extended to cover processing payrolls and recordkeeping for property and cost accounting. Likewise, a number of applications were found for the first generation computers: for example, a UNIVAC computer was successfully used on an extensive trunk estimating job.

The second generation computer owes its existence to the development and advantages of the transistor which was invented at Bell Laboratories in 1948. The transistor had the same capabilities as the older, larger, vacuum tubes, but it was more rugged. Transistors are more efficient because they operate "cold," thereby eliminating the problem of frequent replacement. Also, transistors were much smaller than the vacuum tubes. Therefore, manufacturers could build more powerful machines occupying less floor space.

The second generation computers also possessed a compact memory composed of magnetic iron cores which permitted direct access to any part of the storage area. Although this was an improvement over the first generation machines, which had data that was accessed sequentially, second generation computers still operated on a "batch" mode.

Lecture Section #3

In the mid-1950's, Bell Laboratories began a feasibility study to develop a second generation computer that would take over the Billing and Collection job and replace the punched card electric accounting machinery. Telephone people drawn from the Operating Companies participated in this feasibility study because of their first-hand knowledge of the problems involved. The results of the feasibility study were that commercial computer manufacturers could design computers to do the job so Bell Laboratories discontinued the project.

On the other hand, the AT & T Co. began a coordinated System-wide effort to explore ways in which electronic data processing methods, using second generation computers could be developed to perform various operations of the industry. Accordingly, Bell System operations were grouped into 15 major fields which were considered to be good candidates for electronic data processing (EDP) application. Trial companies were designated for a number of these major fields with the expectation that results could be transferred from company to company. The results of these trial efforts varied.

The New York Telephone Company's Computer--PHOTAC (Photo-typesetting and composing) trial, which involved a computerized typesetting operation for printing the telephone directory, was brought to a successful conclusion. The PHOTAC is now used as the basis for a subsystem currently under development.

Conversely, other trials demonstrated that the PHOTAC computer was not good enough. Newer and more versatile computer equipment would be needed, especially within the operational framework of providing immediate action in response to customer service requests.

Lecture Section #4

One by-product of this System-wide effort was the gaining of a vast reservoir of electronic data processing expertise. The people who participated in these trials gained the knowledge and experience necessary to currently pursue System EDP (Electronic Data Processing) goals on a far more professional and effective basis than was previously possible.

By 1963, it had become apparent that technology had advanced to the point where a new or third generation digital computer would soon become available. Its introduction would greatly expand potential service applications of EDP in the telephone industry. The third generation computer, compared to its second generation predecessor, has the potential of providing a far more flexible EDP system. These machines are capable of operating on a demand similar to the way the nationwide telephone switching network operates in handling Direct Distance Dialed Calls.

Third generation computers, utilizing communications facilites with input-output devices, such as teletypewriters and cathode ray tubes (CRT's), can be operated remotely.

This is an advantage in that work can be fed in from a distance and returned at a distance.

Probably the most important advantage, however, is the fact that third generation computers are no longer restricted to a "batch" mode of operation at one location. Third generation computers can also retrieve information on demand. This is known as "real time" operation as opposed to the batch mode of processing.

When the commercial introduction of these third generation computers, the manufacturers began to provide more technical support in the form of programs or software.

APPENDIX B

Experimental General and Specific Objectives

General Objectives

Goals for Lecture Section #1

1. About data processing in the telephone industry prior to 1945.
2. About "AMA."
3. About the first generation large-scale computers.

Goals for Lecture Section #2

4. What is meant by Mark Sensing and how it works.
5. About the development, creation, and use of the Operating Company accounting system and trunk estimating job.
6. How second generation computers accessed stored data and its mode of operation.

Goals for Lecture Section #3

7. About the Bell Laboratories (Mid-1950's) feasibility study for computerizing the Billing and Collecting jobs.
8. About the full name and use of the New York Telephone Co. computer called PHOTAC.
9. What other trials found about the ability of PHOTAC in handling customer service requests and the result.

Goals for Lecture Section #4

10. One by-product of the system-wide effort using PHOTAC and what was gained.

11. What equipment is used to remotely operate third generation computers and why this is an advantage.
12. About the third generation computer's advantage of having a real time rather than a batch mode operation.

Specific Objectives

Goals for Lecture Section #1

1. The time period during which data processing was done manually.
2. The names of the machines used by accounting people for customer billing before computers were used.
3. The original name for punched cards.
4. How the early equipment used to sort punched cards operated.
5. Two areas in which punched cards were used before computers.
6. The meaning of the "AMA" system.
7. What the AMA system was used for.
8. The historical significance of the AMA system.
9. The time period during which large-scale digital computers first appeared.
10. Which generation of computers used banks of vacuum tubes.
11. How computers developed right after World War II compare with today's machines.

Goals for Lecture Section #2

12. How cards were prepared using Mark Sensing.
13. How cards were "read" using Mark Sensing.
14. Who guided Operating Companies in the developmental work of creating an accounting system.
15. The year that an accounting system was made available to all Bell System Operating Companies.
16. Which two jobs were covered by the electronic accounting machine following the development of the accounting system.
17. What computer was used by the New York Telephone Company for an extensive trunk estimating job.
18. The way second generation computers accessed stored data.
19. The operational mode of second generation computers.

Goals for Lecture Section #3

20. The name of the job that Bell Laboratories (1950's) tried to computerize.
21. Who participated in the Bell Laboratories (1950's) study.
22. Why the Bell Laboratories (1950's) study was discontinued.
23. What job the PHOTAC computer was used for by the New York Telephone Co.
24. The current use of the PHOTAC computer.

25. What other trials demonstrated with reference to whether or not PHOTAC was good enough.
26. Why newer more versatile equipment would be needed rather than PHOTAC.

Goals for Lecture Section #4

27. One by-product of the system-wide effort using PHOTAC.
28. What the people participating in the PHOTAC trials gained.
29. The names of the input-output devices which are used to remotely operate third generation computers.
30. The advantage of remotely operated third generation computers.
31. The most important advantage of third generation computers.
32. How third generation computers retrieve information.
33. The name of the third generation computer's operation which is opposed to batch mode processing.

APPENDIX C

Final Criterion Test

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
2. IN THE MARK SENSING PROCESS, CARDS WERE READ AND PUNCHED _____.
3. BATCH PROCESSING IN EARLY COMPUTERS REQUIRED THAT WORK OF A _____ NATURE BE DONE FIRST AND THEN TAKEN AWAY SO THAT THE NEXT BATCH COULD BE PROCESSED.
4. MACHINES USING _____ OCCUPY LESS FLOOR SPACE THAN THOSE USING VACUUM TUBES.
5. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DONE BY PEOPLE FROM THE _____ CO.
6. THE ABBREVIATION AMA STANDS FOR _____ _____ _____.
7. HISTORICALLY, THE AMA SYSTEM WAS IMPORTANT BECAUSE IT WAS THE FORERUNNER OF MODERN ELECTRONIC _____ SYSTEMS.
8. USING EARLY COMPUTERS, DEVELOPMENTAL WORK AIMED AT CREATING AN ACCOUNTING SYSTEM WAS PERFORMED BY OPERATING COMPANIES UNDER THE GUIDANCE OF THE _____ CO.
9. DATA PROCESSING IN THE TELEPHONE INDUSTRY WAS ON A MANUAL BASIS PRIOR TO THE YEAR _____.
10. SECOND GENERATION COMPUTERS STILL OPERATED IN A _____ MODE.
11. THE MEMORY OF THE FIRST GENERATION COMPUTERS WAS STORED ON PAPER AND _____ TAPE.

12. THE PHOTAC COMPUTER IS NOW USED AS THE BASIS FOR A _____ UNDER DEVELOPMENT.

13. THIRD GENERATION COMPUTERS CAN RETRIEVE INFORMATION ON _____.

14. FIRST GENERATION COMPUTER'S DATA HAD TO BE PROCESSED AND RETRIEVED _____.

15. LARGE SCALE DIGITAL COMPUTERS FOR BUSINESS APPLICATIONS MADE THEIR FIRST APPEARANCE BETWEEN THE YEARS _____ AND 1954.

16. THIRD GENERATION COMPUTERS USE INPUT-OUTPUT DEVICES SUCH AS CATHODE RAY TUBES (CRT'S) AND _____.

17. IN TERMS OF SIZE, THE TRANSISTOR IS _____ THAN THE VACUUM TUBE.

18. COMPARED TO TODAY'S COMPUTERS, FIRST GENERATION COMPUTERS WERE VERY _____.

19. THIRD GENERATION COMPUTERS ARE CAPABLE OF OPERATING ON _____ SIMILAR TO THE HANDLING OF DIRECT DISTANCE DIALED CALLS.

20. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD NOW PERFORM _____ IN ADDITION TO SORTING, SUMMARIZING, AND PRINTING RESULTS.

21. WITH THE INTRODUCTION OF THIRD GENERATION COMPUTERS, MANUFACTURERS BEGAN TO PROVIDE MORE TECHNICAL SUPPORT IN THE FORM OF PROGRAMS OR _____.

22. THE THIRD GENERATION COMPUTER WOULD GREATLY EXPAND POTENTIAL _____ APPLICATIONS IN THE TELEPHONE INDUSTRY.

23. THE MOST IMPORTANT ADVANTAGE OF THIRD GENERATION COMPUTERS IS THAT THEY ARE NO LONGER RESTRICTED TO A BATCH MODE OF OPERATION AT _____ LOCATION.

24. THE PEOPLE WHO PARTICIPATED IN THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WERE ABLE TO PURSUE NEW DATA PROCESSING GOALS ON A MORE _____ BASIS THAN WAS PREVIOUSLY POSSIBLE.

25. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

26. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

27. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

28. PUNCHED CARDS WERE ORIGINALLY KNOWN AS _____ CARDS.

29. THE AMA SYSTEM WAS USED FOR _____ PURPOSES.

30. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DISCONTINUED WHEN IT BECAME APPARENT THAT _____ COMPUTERS COULD DO THE JOB.

31. THE NEW YORK TELEPHONE CO. COMPUTER,PHOTAC, WAS USED TO COMPUTERIZE A _____ OPERATION.

32. USING EARLY COMPUTERS, AN ACCOUNTING SYSTEM WAS DEVELOPED AND MADE AVAILABLE TO ALL BELL SYSTEM OPERATING COMPANIES BY THE YEAR_____.

33. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

34. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

35. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

36. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ Co.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

43. IT WAS APPARENT THAT A NEW THIRD GENERATION COMPUTER WOULD BECOME AVAILABLE BY THE YEAR _____.

44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

46. IN THE MID-1950'S, BELL LABORATORIES BEGAN A FEASIBILITY STUDY TO DEVELOP A SECOND GENERATION COMPUTER THAT WOULD TAKE OVER THE BILLING AND _____ JOB.

47. AFTER SEVERAL TRIALS THE PHOTAC COMPUTER WAS FOUND TO BE _____.

48. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD PROCESS PUNCHED CARDS _____ THAN BEFORE.

49. WHEN DATA PROCESSING WAS DONE MANUALLY, ACCOUNTANTS USED ADDRESSOGRAPH PLATES, CALCULATORS AND _____ MACHINES TO DO THE TASK OF CUSTOMER BILLING.

50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP. THEN PUT THIS TEST IN ENVELOPE Y.

APPENDIX D

Vocabulary Questions

Vocabulary Questions

1. mumble

   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire

   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush

   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive

   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign

   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary

   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer

   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox

   1-conventional
   2-straight
   3-surgical
   4-right-angled
   5-religious

9. stripling

   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

10. salubrious

    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid

    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate

    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete

1-full
2-elderly
3-resentful
4-discredited
5-restful

14. frieze

1-fringe of curls on the forehead
2-statue
3-ornamental band
4-embroidery
5-sherbet

15. treacle

1-sewing maching
2-framework
3-leak
4-apple butter
5-molasses

16. ignominious

1-inflammable
2-elflike
3-unintelligent
4-disgraceful
5-mysterious

17. abjure

1-make certain
2-arrest
3-renounce
4-abuse
5-lose

18. duress

1-period of time
2-distaste
3-courage
4-hardness
5-compulsion

19. bayonet

1-small tent
2-basket
3-helmet
4-sharp weapon
5-short gun

20. astound

1-scold severly
2-make angry
3-surprise greatly
4-drive out
5-ascertain

21. contamination

1-contradiction
2-contempt
3-warning
4-pollution
5-continuation

22. amplify

1-electrify
2-expand
3-cut off
4-signify
5-supply

23. mural
pertaining to

1-growth
2-manners
3-the eyes
4-war
5-a wall

24. hale

1-glad
2-fortunate
3-tall
4-robust
5-ready

25. meander

1-marvel
2-predict
3-slope
4-forget
5-wind

26. burnish

1-polish
2-wave
3-dye
4-heat
5-consume

27. duplicity

1-extent
2-double-dealing
3-agreement
4-cleverness
5-overlapping

28. mundane

1-worldly
2-obstinate
3-deafening
4-servile
5-penniless

29. deleterious

1-injurious
2-hysterical
3-critical
4-slow
5-thinned out

30. nascent

1-colorful
2-broad
3-unpleasant
4-floating
5-beginning

31. prolific

1-freely reproductive
2-prehistoric
3-talented
4-highly temperamental
5-frivolous

32. paroxysm

1-bleach
2-disaster
3-storm
4-fit
5-revolution

33. antipodal

1-outmoded
2-slanted
3-melodious
4-opposite
5-four-footed

34. acrimony

1-promptness
2-boredom
3-divorce
4-stupidity
5-bitterness

35. lissome

1-lonely
2-young
3-dreamy
4-supple
5-dainty

36. succinct

1-sudden
2-concise
3-prosperous
4-literary
5-cunning

Vocabulary Questions Used As Filler Material for Control Group (Not Scored)

1. nubile

   1-sexy
   2-rough
   3-intestinal
   4-artful
   5-rapid

2. impugn

   1-remove
   2-castigate
   3-assail
   4-deny
   5-authenticate

3. moniker

   1-optical
   2-nickname
   3-failure
   4-handkerchief
   5-shackle

4. resilient

   1-stiff
   2-bouncy
   3-frugal
   4-resistant
   5-resolute

5. riffle

   1-wave
   2-flag
   3-dance
   4-food
   5-illness

6. impede

   1-compete
   2-hinder
   3-hone
   4-crowd
   5-disembark

7. convivial

   1-enthusiastic
   2-ridiculous
   3-festive
   4-deadly
   5-insincere

8. concierge

   1-policeman
   2-arsonist
   3-bouquet
   4-doorkeeper
   5-hostess

9. conciliate

   1-vacillate
   2-boast
   3-unite
   4-congratulate
   5-destroy

10. hovel

    1-shed
    2-tool
    3-indigent
    4-book
    5-cafe

11. opus

    1-performance
    2-animal
    3-composition
    4-beginning
    5-aperture

12. raiment

    1-sunshine
    2-clothing
    3-golden
    4-meal
    5-remnant

13. sleight

1-illusion
2-lithe
3-dexterity
4-ignore
5-clumsy

14. tryst

1-meeting
2-attempt
3-failure
4-truth
5-poem

15. vacuity

1-hollow
2-yearly
3-emptiness
4-acridness
5-desertion

16. munificent

1-parsimonious
2-bountiful
3-beautiful
4-public
5-fastidious

17. inadvertent

1-intentional
2-unavoidable
3-negligent
4-unexpected
5-negotiable

18. gnomic

1-elfin
2-pithy
3-enormous
4-potent
5-chronic

19. fulminate

1-ignite
2-aerate
3-detonate
4-culminate
5-situate

20. eradicate

1-erase
2-embossed
3-radiate
4-fumigate
5-organize

21. deride

1-extol
2-ridicule
3-deny
4-determine
5-ignore

22. commodious

1-sparse
2-spacious
3-uproarious
4-artificial
5-motherly

23. coffer

1-tomb
2-strongbox
3-deacon
4-stream
5-parlor

24. chortle

1-wheeze
2-chuckle
3-whisper
4-instrument
5-device

25. cauterize

1-freeze
2-solder
3-burn
4-warn
5-chastise

26. candid

1-bottled
2-frank
3-dishonest
4-expected
5-frightened

27. charisma

1-presence
2-luminous
3-charm
4-honesty
5-sobriety

28. larch

1-conflict
2-pine tree
3-mountain
4-beggar
5-jump

29. dyspeptic

1-iconoclastic
2-ornery
3-gloomy
4-distinct
5-disoriented

30. numismatist

1-mathematician
2-coin studier
3-exhibitionist
4-stamp collector
5-benefactor

31. rife

1-chaotic
2-bountiful
3-dreamy
4-angered
5-overjoyed

32. sedition

1-partition
2-alienation
3-rebellion
4-suspicion
5-position

33. seine

1-strait
2-trout
3-fishnet
4-necklace
5-seam

34. wherry

1-cautious
2-belligerent
3-rowboat
4-alcohol
5-ill

35. yeoman

1-factotum
2-manservant
3-shepherd
4-gardener
5-sailor

36. zephyr

1-dirigible
2-instrument
3-wildlife
4-breeze
5-current

APPENDIX E

Audiotape Script of Experiment

Audiotape Script of Experiment

Throughout this study I will direct you to open your booklets to a particular page and perform the task specified by the instructions. I will tell you how much time you will have to perform each task. Follow all directions carefully. I will read you 4 sections of a prepared lecture. You will be tested after all the lecture has been read.

Please open your booklets to page zero. You will have ½ minute to read the abstract which appears on that page.

- ½ minute -

Now please turn to page 2. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 3. You should have your booklet open to this page during the first section of the lecture.

Lecture Section Number One: "Computer Development in the Bell Telephone System"

- 18 sentences -

Please turn to page 4. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 6. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 7. You should have your booklet open to this page during the second section of the lecture.

Lecture Section #2

- 13 sentences -

Please turn to page 8. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 10. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 11. You should have your booklet open to this page during the third section of the lecture.

Lecture Section #3

- 11 sentences -

Please turn to page 12. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 14. You have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 15. You should have your booklet open to this page during the final section of the lecture.

Lecture Section #4

- 12 sentences -

If page 15 in your booklet is pink you will have 18 minutes to perform the task specified on page 15a which directly follows page 15. If page 15 in your booklet is blue, you will have 2½ minutes to perform the task specified on page 15a which directly follows page 15. I will give you further directions after the appropriate times have elapsed. All of you may begin now.

- 2½ minutes -

Those with the blue page 15, please turn to page 17a. You will have 18 minutes to perform the task specified on that page.

- 15½ minutes -

Those with the pink page 15, please turn to page 17. You will have 2½ minutes to perform the task specified on that page.

- 2½ minutes -

Please turn to page 18 in your booklets. You will have 1 minute to answer the questions on this page.

- 1 minute -

Please close your booklets. You have finished. Thank you.

APPENDIX F

Experimental Booklets

Experimental Booklet for Specific Before Treatment Group

DO NOT OPEN THIS BOOKLET

UNTIL YOU ARE INSTRUCTED TO DO SO

ABSTRACT

The passage you will hear is about data processing in the telephone industry. It deals with data processing prior to the development of computers, and discusses first, second, and third generation computers. How and why the computers were developed and their individual impacts on the progress of data processing in the telephone industry are considered. Comparisons among different computers with respect to the mechanics of operation, efficiency and effectiveness are also discussed. The telephone jobs that have been replaced by the use of computers are mentioned. By-products of system-wide efforts to improve data processing are included in the text of the passage.

Instructions

This page contains a "List of Goals" related to a passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

1. The time period during which data processing was done manually.
2. The names of the machines used by accounting people for customer billing before computers were used.
3. The original name for punched cards.
4. How the early equipment used to sort punched cards operated.
5. Two areas in which punched cards were used before computers.
6. The meaning of the "AMA" system.
7. What the AMA system was used for.
8. The historical significance of the AMA system.
9. The time period during which large-scale digital computers first appeared.
10. Which generation of computers used banks of vacuum tubes.
11. How computers developed right after World War II compare with today's machines.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 1.

Instructions

This is a test of your knowledge of word meanings. Look at the sample below. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

jovial
1-refreshing
2-scared
3-thickset
4-wise
X-jolly

The answer to the sample item is number 5; therefore, an X has been put through number 5.

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surgical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains another "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

12. How cards were prepared using Mark Sensing.
13. How cards were "read" using Mark Sensing.
14. Who guided Operating Companies in the developmental work of creating an accounting system.
15. The year that an accounting system was made available to all Bell System Operating Companies.
16. Which two jobs were covered by the electronic accounting machine following the development of the accounting system.
17. What computer was used by the New York Telephone Company for an extensive trunk estimating job.
18. The way second generation computers accessed stored data.
19. The operational mode of second generation computers.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 2.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

10. salubrious
    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid
    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate
    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete
    1-full
    2-elderly
    3-resentful
    4-discredited
    5-restful

14. frieze
    1-fringe of curls on the forehead
    2-statue
    3-ornamental band
    4-embroidery
    5-sherbet

15. treacle
    1-sewing machine
    2-framework
    3-leak
    4-apple butter
    5-molasses

16. ignominious
    1-inflammable
    2-elflike
    3-unintelligent
    4-disgraceful
    5-mysterious

17. abjure
    1-make certain
    2-arrest
    3-renounce
    4-abuse
    5-lose

18. duress
    1-period of time
    2-distaste
    3-courage
    4-hardness
    5-compulsion

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains another "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

20. The name of the job that Bell Laboratories (1950's) tried to computerize.

21. Who participated in the Bell Laboratories (1950's) study.

22. Why the Bell Laboratories (1950's) study was discontinued.

23. What job the PHOTAC computer was used for by the New York Telephone Company.

24. The current use of the PHOTAC computer.

25. What other trials demonstrated with reference to whether or not PHOTAC was good enough.

26. Why newer, more versatile equipment would be needed rather than PHOTAC.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 3.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

19. bayonet
    1-small tent
    2-basket
    3-helmet
    4-sharp weapon
    5-short gun

20. astound
    1-scold severely
    2-make angry
    3-surprise greatly
    4-drive out
    5-ascertain

21. contamination
    1-contradiction
    2-contempt
    3-warning
    4-pollution
    5-continuation

22. amplify
    1-electrify
    2-expand
    3-cut off
    4-signify
    5-supply

23. mural
    pertaining to
    1-growth
    2-manners
    3-the eyes
    4-war
    5-a wall

24. hale
    1-glad
    2-fortunate
    3-tall
    4-robust
    5-ready

25. meander
    1-marvel
    2-predict
    3-slope
    4-forget
    5-wind

26. burnish
    1-polish
    2-wave
    3-dye
    4-heat
    5-consume

27. duplicity
    1-extent
    2-double-dealing
    3-agreement
    4-cleverness
    5-overlapping

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains the final "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

27. One by-product of the system-wide effort using PHOTAC.
28. What the people participating in the PHOTAC trials gained.
29. The names of the input-output devices which are used to remotely operate third generation computers.
30. The advantage of remotely operated third generation computers.
31. The most important advantage of third generation computers.
32. How third generation computers retrieve information.
33. The name of the third generation computer's operation which is opposed to batch mode processing.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 4.

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

DO NOT REFER TO ANY EARLIER PAGES IN THIS BOOKLET.

---

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
2. IN THE MARK SENSING PROCESS, CARDS WERE READ AND PUNCHED _____.
3. BATCH PROCESSING IN EARLY COMPUTERS REQUIRED THAT WORK OF A _____ NATURE BE DONE FIRST AND THEN TAKEN AWAY SO THAT THE NEXT BATCH COULD BE PROCESSED.
4. MACHINES USING _____ OCCUPY LESS FLOOR SPACE THAN THOSE USING VACUUM TUBES.
5. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DONE BY PEOPLE FROM THE _____ CO.
6. THE ABBREVIATION AMA STANDS FOR _____ _____ _____.
7. HISTORICALLY, THE AMA SYSTEM WAS IMPORTANT BECAUSE IT WAS THE FORERUNNER OF MODERN ELECTRONIC _____ SYSTEMS.
8. USING EARLY COMPUTERS, DEVELOPMENTAL WORK AIMED AT CREATING AN ACCOUNTING SYSTEM WAS PERFORMED BY OPERATING COMPANIES UNDER THE GUIDANCE OF THE _____ CO.
9. DATA PROCESSING IN THE TELEPHONE INDUSTRY WAS ON A MANUAL BASIS PRIOR TO THE YEAR _____.
10. SECOND GENERATION COMPUTERS STILL OPERATED IN A _____ MODE.
11. THE MEMORY OF THE FIRST GENERATION COMPUTERS WAS STORED ON PAPER AND _____ TAPE.

12. THE PHOTAC COMPUTER IS NOW USED AS THE BASIS FOR A _____ UNDER DEVELOPMENT.

13. THIRD GENERATION COMPUTERS CAN RETRIEVE INFORMATION ON _____.

14. FIRST GENERATION COMPUTER'S DATA HAD TO BE PROCESSED AND RETRIEVED _____.

15. LARGE SCALE DIGITAL COMPUTERS FOR BUSINESS APPLICATIONS MADE THEIR FIRST APPEARANCE BETWEEN THE YEARS _____ AND 1954.

16. THIRD GENERATION COMPUTERS USE INPUT-OUTPUT DEVICES SUCH AS CATHODE RAY TUBES (CRT'S) AND _____.

17. IN TERMS OF SIZE, THE TRANSISTOR IS _____ THAN THE VACUUM TUBE.

18. COMPARED TO TODAY'S COMPUTERS, FIRST GENERATION COMPUTERS WERE VERY _____.

19. THIRD GENERATION COMPUTERS ARE CAPABLE OF OPERATING ON _____ SIMILAR TO THE HANDLING OF DIRECT DISTANCE DIALED CALLS.

20. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD NOW PERFORM _____ IN ADDITION TO SORTING, SUMMARIZING, AND PRINTING RESULTS.

21. WITH THE INTRODUCTION OF THIRD GENERATION COMPUTERS, MANUFACTURERS BEGAN TO PROVIDE MORE TECHNICAL SUPPORT IN THE FORM OF PROGRAMS OR _____.

22. THE THIRD GENERATION COMPUTER WOULD GREATLY EXPAND POTENTIAL _____ APPLICATIONS IN THE TELEPHONE INDUSTRY.

23. THE MOST IMPORTANT ADVANTAGE OF THIRD GENERATION COMPUTERS IS THAT THEY ARE NO LONGER RESTRICTED TO A BATCH MODE OF OPERATION AT _____ LOCATION.

24. THE PEOPLE WHO PARTICIPATED IN THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WERE ABLE TO PURSUE NEW DATA PROCESSING GOALS ON A MORE _____ BASIS THAN WAS PREVIOUSLY POSSIBLE.

25. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

26. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

27. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

28. PUNCHED CARDS WERE ORIGINALLY KNOWN AS _____ CARDS.

29. THE AMA SYSTEM WAS USED FOR _____ PURPOSES.

30. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DISCONTINUED WHEN IT BECAME APPARENT THAT _____ COMPUTERS COULD DO THE JOB.

31. THE NEW YORK TELEPHONE CO. COMPUTER, PHOTAC, WAS USED TO COMPUTERIZE A _____ OPERATION.

32. USING EARLY COMPUTERS, AN ACCOUNTING SYSTEM WAS DEVELOPED AND MADE AVAILABLE TO ALL BELL SYSTEM OPERATING COMPANIES BY THE YEAR_____.

33. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

34. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

35. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

36. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ Co.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

43. IT WAS APPARENT THAT A NEW THIRD GENERATION COMPUTER WOULD BECOME AVAILABLE BY THE YEAR _____.

44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

46. IN THE MID-1950'S, BELL LABORATORIES BEGAN A FEASIBILITY STUDY TO DEVELOP A SECOND GENERATION COMPUTER THAT WOULD TAKE OVER THE BILLING AND _____ JOB.

47. AFTER SEVERAL TRIALS THE PHOTAC COMPUTER WAS FOUND TO BE _____.

48. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD PROCESS PUNCHED CARDS _____ THAN BEFORE.

49. WHEN DATA PROCESSING WAS DONE MANUALLY, ACCOUNTANTS USED ADDRESSOGRAPH PLATES, CALCULATORS AND _____ MACHINES TO DO THE TASK OF CUSTOMER BILLING.

50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

28. mundane
    1-worldly
    2-obstinate
    3-deafening
    4-servile
    5-penniless

29. deleterious
    1-injurious
    2-hysterical
    3-critical
    4-slow
    5-thinned out

30. nascent
    1-colorful
    2-broad
    3-unpleasant
    4-floating
    5-beginning

31. prolific
    1-freely reproductive
    2-prehistoric
    3-talented
    4-highly temperamental
    5-frivolous

32. paroxysm
    1-bleach
    2-disaster
    3-storm
    4-fit
    5-revolution

33. antipodal
    1-outmoded
    2-slanted
    3-melodious
    4-opposite
    5-four-footed

34. acrimony
    1-promptness
    2-boredom
    3-divorce
    4-stupidity
    5-bitterness

35. lissome
    1-lonely
    2-young
    3-dreamy
    4-supple
    5-dainty

36. succinct
    1-sudden
    2-concise
    3-prosperous
    4-literary
    5-cunning

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

INVENTORY

PLEASE CIRCLE YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. 18 years or under
   2. 19-21 years
   3. 22-24 years
   4. 25 years or over

3. Were you familiar with the content of the lectures before participating in this experiment?

   1. I knew most of the content prior to this experiment.
   2. I knew some of the content prior to this experiment.
   3. I knew very little of the content prior to this experiment.
   4. I knew none of the content prior to this experiment.

4. Did you find your participation in this experiment interesting ?

   1. very interesting
   2. somewhat interesting
   3. not very interesting
   4. not at all interesting

5. Were there sections of this experiment that you found confusing ?

   1. Yes (please explain below)
   2. No

_____

_____

_____

_____

Experimental Booklet for Specific After Treatment Group

DO NOT OPEN THIS BOOKLET

UNTIL YOU ARE INSTRUCTED TO DO SO

ABSTRACT

The passage you will hear is about data processing in the telephone industry. It deals with data processing prior to the development of computers, and discusses first, second, and third generation computers. How and why the computers were developed and their individual impacts on the progress of data processing in the telephone industry are considered. Comparisons among different computers with respect to the mechanics of operation, efficiency and effectiveness are also discussed. The telephone jobs that have been replaced by the use of computers are mentioned. By-products of system-wide efforts to improve data processing are included in the text of the passage.

Instructions

This is a test of your knowledge of word meanings. Look at the sample below. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

jovial
1-refreshing
2-scared
3-thickset
4-wise
5-jolly

The answer to the sample item is number 5; therefore, an X has been put through number 5.

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surtical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 1.

Instructions

This page contains a "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

1. The time period during which data processing was done manually.
2. The names of the machines used by accounting people for customer billing before computers were used.
3. The original name for punched cards.
4. How the early equipment used to sort punched cards operated.
5. Two areas in which punched cards were used before computers.
6. The meaning of the "AMA" system.
7. What the AMA system was used for.
8. The historical significance of the AMA system.
9. The time period during which large-scale digital computers first appeared.
10. Which generation of computers used banks of vacuum tubes.
11. How computers developed right after World War II compare with today's machines.

Continue to re-read this List of Goals until the tape instructs you to stop. Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

10. salubrious
    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid
    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate
    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete
    1-full
    2-elderly
    3-resentful
    4-discredited
    5-restful

14. frieze
    1-fringe of curls on the forehead
    2-statue
    3-ornamental band
    4-embroidery
    5-sherbet

15. treacle
    1-sewing machine
    2-framework
    3-leak
    4-apple butter
    5-molasses

16. ignominious
    1-inflammable
    2-elflike
    3-unintelligent
    4-disgraceful
    5-mysterious

17. abjure
    1-make certain
    2-arrest
    3-renounce
    4-abuse
    5-lose

18. duress
    1-period of time
    2-distaste
    3-courage
    4-hardness
    5-compulsion

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 2.

Instructions

This page contains another "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

12. How cards were prepared using Mark Sensing.
13. How cards were "read" using Mark Sensing.
14. Who guided Operating Companies in the developmental work of creating an accounting system.
15. The year that an accounting system was made available to all Bell System Operating Companies.
16. Which two jobs were covered by the electronic accounting machine following the development of the accounting system.
17. What computer was used by the New York Telephone Company for an extensive trunk estimating job.
18. The way second generation computers accessed stored data.
19. The operational mode of second generation computers.

Continue to re-read this List of Goals until the tape instructs you to stop. Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

19. bayonet
    1-small tent
    2-basket
    3-helmet
    4-sharp weapon
    5-short gun

20. astound
    1-scold severely
    2-make angry
    3-surprise greatly
    4-drive out
    5-ascertain

21. contamination
    1-contradiction
    2-contempt
    3-warning
    4-pollution
    5-continuation

22. amplify
    1-electrify
    2-expand
    3-cut off
    4-signify
    5-supply

23. mural
    pertaining to
    1-growth
    2-manners
    3-the eyes
    4-war
    5-a wall

24. hale
    1-glad
    2-fortunate
    3-tall
    4-robust
    5-ready

25. meander
    1-marvel
    2-predict
    3-slope
    4-forget
    5-wind

26. burnish
    1-polish
    2-wave
    3-dye
    4-heat
    5-consume

27. duplicity
    1-extent
    2-double-dealing
    3-agreement
    4-cleverness
    5-overlapping

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 3.

Instructions

This page contains another "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

20. The name of the job that Bell Laboratories (1950's) tried to computerize.

21. Who participated in the Bell Laboratories (1950's) study.

22. Why the Bell Laboratories (1950's) study was discontinued.

23. What job the PHOTAC computer was used for by the New York Telephone Company.

24. The current use of the PHOTAC computer.

25. What other trials demonstrated with reference to whether or not PHOTAC was good enough.

26. Why newer, more versatile equipment would be needed rather than PHOTAC.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

28. mundane
    1-worldly
    2-obstinate
    3-deafening
    4-servile
    5-penniless

29. deleterious
    1-injurious
    2-hysterical
    3-critical
    4-slow
    5-thinned out

30. nascent
    1-colorful
    2-broad
    3-unpleasant
    4-floating
    5-beginning

31. prolific
    1-freely reproductive
    2-prehistoric
    3-talented
    4-highly temperamental
    5-frivolous

32. paroxysm
    1-bleach
    2-disaster
    3-storm
    4-fit
    5-revolution

33. antipodal
    1-outmoded
    2-slanted
    3-melodious
    4-opposite
    5-four-footed

34. acrimony
    1-promptness
    2-boredom
    3-divorce
    4-stupidity
    5-bitterness

35. lissome
    1-lonely
    2-young
    3-dreamy
    4-supple
    5-dainty

36. succinct
    1-sudden
    2-concise
    3-prosperous
    4-literary
    5-cunning

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 4.

Instructions

This page contains another "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

27. One by-product of the system-wide effort using PHOTAC.
28. What the people participating in the PHOTAC trials gained.
29. The names of the input-output devices which are used to remotely operate third generation computers.
30. The advantage of remotely operated third generation computers.
31. The most important advantage of third generation computers.
32. How third generation computers retrieve information.
33. The name of the third generation computer's operation which is opposed to batch mode processing.

Continue to re-read this List of Goals until the tape instructs you to stop and begin the test. Do not turn this page until you are instructed to do so.

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

DO NOT REFER TO ANY EARLIER PAGES IN THIS BOOKLET.

---

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
2. IN THE MARK SENSING PROCESS, CARDS WERE READ AND PUNCHED _____.
3. BATCH PROCESSING IN EARLY COMPUTERS REQUIRED THAT WORK OF A _____ NATURE BE DONE FIRST AND THEN TAKEN AWAY SO THAT THE NEXT BATCH COULD BE PROCESSED.
4. MACHINES USING _____ OCCUPY LESS FLOOR SPACE THAN THOSE USING VACUUM TUBES.
5. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DONE BY PEOPLE FROM THE _____ CO.
6. THE ABBREVIATION AMA STANDS FOR _____ _____ _____.
7. HISTORICALLY, THE AMA SYSTEM WAS IMPORTANT BECAUSE IT WAS THE FORERUNNER OF MODERN ELECTRONIC _____ SYSTEMS.
8. USING EARLY COMPUTERS, DEVELOPMENTAL WORK AIMED AT CREATING AN ACCOUNTING SYSTEM WAS PERFORMED BY OPERATING COMPANIES UNDER THE GUIDANCE OF THE _____ CO.
9. DATA PROCESSING IN THE TELEPHONE INDUSTRY WAS ON A MANUAL BASIS PRIOR TO THE YEAR _____.
10. SECOND GENERATION COMPUTERS STILL OPERATED IN A _____ MODE.
11. THE MEMORY OF THE FIRST GENERATION COMPUTERS WAS STORED ON PAPER AND _____ TAPE.

4. THE PEOPLE WHO PARTICIPATED IN THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WERE ABLE TO PURSUE NEW DATA PROCESSING GOALS ON A MORE _____ BASIS THAN WAS PREVIOUSLY POSSIBLE.

5. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

6. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

7. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

8. PUNCHED CARDS WERE ORIGINALLY KNOWN AS _____ CARDS.

9. THE AMA SYSTEM WAS USED FOR _____ PURPOSES.

0. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DISCONTINUED WHEN IT BECAME APPARENT THAT _____ COMPUTERS COULD DO THE JOB.

1. THE NEW YORK TELEPHONE CO. COMPUTER, PHOTAC, WAS USED TO COMPUTERIZE A _____ OPERATION.

2. USING EARLY COMPUTERS, AN ACCOUNTING SYSTEM WAS DEVELOPED AND MADE AVAILABLE TO ALL BELL SYSTEM OPERATING COMPANIES BY THE YEAR_____.

3. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

4. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

5. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

6. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ CO.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

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44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

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50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP.

INVENTORY

PLEASE CIRCLE YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. 18 years or under
   2. 19-21 years
   3. 22-24 years
   4. 25 years or over

3. Were you familiar with the content of the lectures before participating in this experiment ?

   1. I knew most of the content prior to this experiment.
   2. I knew some of the content prior to this experiment.
   3. I knew very little of the content prior to this experiment.
   4. I knew none of the content prior to this experiment.

4. Did you find your participation in this experiment interesting ?

   1. very interesting
   2. somewhat interesting
   3. not very interesting
   4. not at all interesting

5. Were there sections of this experiment that you found confusing ?

   1. Yes (please explain below)
   2. No

_____

_____

_____

_____

Experimental Booklet for General Before Treatment Group

DO NOT OPEN THIS BOOKLET

UNTIL YOU ARE INSTRUCTED TO DO SO

ABSTRACT

The passage you will hear is about data processing in the telephone industry. It deals with data processing prior to the development of computers, and discusses first, second, and third generation computers. How and why the computers were developed and their individual impacts on the progress of data processing in the telephone industry are considered. Comparisons among different computers with respect to the mechanics of operation, efficiency and effectiveness are also discussed. The telephone jobs that have been replaced by the use of computers are mentioned. By-products of system-wide efforts to improve data processing are included in the text of the passage.

Instructions

This page contains a "List of Goals" related to a passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to the goals. The goals are in the same order as they appear in the passage.

List of Goals

1. About data processing in the telephone industry prior to 1945.
2. About "AMA."
3. About the first generation large-scale computers.

Continue to re-read this List of Goals until the tape instructs you to stop. Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 1.

Instructions

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2-scared
3-thickset
4-wise
5-jolly

The answer to the sample item is number 5; therefore, an X has been put through number 5.

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   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surgical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains another "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

4. What is meant by Mark Sensing and how it works.
5. About the development, creation, and use of the Operating Company accounting system and trunk estimating job.
6. How second generation computers accessed stored data and its mode of operation.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 2.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

10. salubrious
    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid
    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate
    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete
    1-full
    2-elderly
    3-resentful
    4-discredited
    5-restful

14. frieze
    1-fringe of curls on the forehead
    2-statue
    3-ornamental band
    4-embroidery
    5-sherbet

15. treacle
    1-sewing machine
    2-framework
    3-leak
    4-apple butter
    5-molasses

16. ignominious
    1-inflammable
    2-elflike
    3-unintelligent
    4-disgraceful
    5-mysterious

17. abjure
    1-make certain
    2-arrest
    3-renounce
    4-abuse
    5-lose

18. duress
    1-period of time
    2-distaste
    3-courage
    4-hardness
    5-compulsion

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains another "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

7. About the Bell Laboratories (mid-1950's) feasibility study for computerizing the Billing and Collecting jobs.
8. About the full name and use of the New York Telephone Company computer called PHOTAC.
9. What other trials found about the ability of PHOTAC in handling customer service requests and the result.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 3.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

19. bayonet
    1-small tent
    2-basket
    3-helmet
    4-sharp weapon
    5-short gun

20. astound
    1-scold severely
    2-make angry
    3-surprise greatly
    4-drive out
    5-ascertain

21. contamination
    1-contradiction
    2-contempt
    3-warning
    4-pollution
    5-continuation

22. amplify
    1-electrify
    2-expand
    3-cut off
    4-signify
    5-supply

23. mural
    pertaining to
    1-growth
    2-manners
    3-the eyes
    4-war
    5-a wall

24. hale
    1-glad
    2-fortunate
    3-tall
    4-robust
    5-ready

25. meander
    1-marvel
    2-predict
    3-slope
    4-forget
    5-wind

26. burnish
    1-polish
    2-wave
    3-dye
    4-heat
    5-consume

27. duplicity
    1-extent
    2-double-dealing
    3-agreement
    4-cleverness
    5-overlapping

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This page contains the final "List of Goals" related to the passage which will follow on the tape. Read the goals carefully. You do not have to learn everything in the lecture. Learn only the information in the passage which is relevant to this list of goals. The goals are in the same order as they appear in the passage.

List of Goals

10. One by-product of the system-wide effort using PHOTAC and what was gained.

11. What equipment is used to remotely operate third generation computers and why this is an advantage.

12. About the third generation computer's advantage of having a real time rather than a batch mode operation.

Continue to re-read this List of Goals until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 4.

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

DO NOT REFER TO ANY EARLIER PAGES IN THIS BOOKLET.

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
2. IN THE MARK SENSING PROCESS, CARDS WERE READ AND PUNCHED _____.
3. BATCH PROCESSING IN EARLY COMPUTERS REQUIRED THAT WORK OF A _____ NATURE BE DONE FIRST AND THEN TAKEN AWAY SO THAT THE NEXT BATCH COULD BE PROCESSED.
4. MACHINES USING _____ OCCUPY LESS FLOOR SPACE THAN THOSE USING VACUUM TUBES.
5. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DONE BY PEOPLE FROM THE _____ CO.
6. THE ABBREVIATION AMA STANDS FOR _____ _____ _____.
7. HISTORICALLY, THE AMA SYSTEM WAS IMPORTANT BECAUSE IT WAS THE FORERUNNER OF MODERN ELECTRONIC _____ SYSTEMS.
8. USING EARLY COMPUTERS, DEVELOPMENTAL WORK AIMED AT CREATING AN ACCOUNTING SYSTEM WAS PERFORMED BY OPERATING COMPANIES UNDER THE GUIDANCE OF THE _____ CO.
9. DATA PROCESSING IN THE TELEPHONE INDUSTRY WAS ON A MANUAL BASIS PRIOR TO THE YEAR _____.
10. SECOND GENERATION COMPUTERS STILL OPERATED IN A _____ MODE.
11. THE MEMORY OF THE FIRST GENERATION COMPUTERS WAS STORED ON PAPER AND _____ TAPE.

12. THE PHOTAC COMPUTER IS NOW USED AS THE BASIS FOR A _____ UNDER DEVELOPMENT.
13. THIRD GENERATION COMPUTERS CAN RETRIEVE INFORMATION ON _____.
14. FIRST GENERATION COMPUTER'S DATA HAD TO BE PROCESSED AND RETRIEVED _____.
15. LARGE SCALE DIGITAL COMPUTERS FOR BUSINESS APPLICATIONS MADE THEIR FIRST APPEARANCE BETWEEN THE YEARS _____ AND 1954.
16. THIRD GENERATION COMPUTERS USE INPUT-OUTPUT DEVICES SUCH AS CATHODE RAY TUBES (CRT'S) AND _____.
17. IN TERMS OF SIZE, THE TRANSISTOR IS _____ THAN THE VACUUM TUBE.
18. COMPARED TO TODAY'S COMPUTERS, FIRST GENERATION COMPUTERS WERE VERY _____.
19. THIRD GENERATION COMPUTERS ARE CAPABLE OF OPERATING ON _____ SIMILAR TO THE HANDLING OF DIRECT DISTANCE DIALED CALLS.
20. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD NOW PERFORM _____ _____ IN ADDITION TO SORTING, SUMMARIZING, AND PRINTING RESULTS.
21. WITH THE INTRODUCTION OF THIRD GENERATION COMPUTERS, MANUFACTURERS BEGAN TO PROVIDE MORE TECHNICAL SUPPORT IN THE FORM OF PROGRAMS OR _____.
22. THE THIRD GENERATION COMPUTER WOULD GREATLY EXPAND POTENTIAL _____ APPLICATIONS IN THE TELEPHONE INDUSTRY.
23. THE MOST IMPORTANT ADVANTAGE OF THIRD GENERATION COMPUTERS IS THAT THEY ARE NO LONGER RESTRICTED TO A BATCH MODE OF OPERATION AT _____ LOCATION.

24. THE PEOPLE WHO PARTICIPATED IN THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WERE ABLE TO PURSUE NEW DATA PROCESSING GOALS ON A MORE _____ BASIS THAN WAS PREVIOUSLY POSSIBLE.

25. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

26. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

27. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

28. PUNCHED CARDS WERE ORIGINALLY KNOWN AS _____ CARDS.

29. THE AMA SYSTEM WAS USED FOR _____ PURPOSES.

30. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DISCONTINUED WHEN IT BECAME APPARENT THAT _____ COMPUTERS COULD DO THE JOB.

31. THE NEW YORK TELEPHONE CO. COMPUTER,PHOTAC, WAS USED TO COMPUTERIZE A _____ OPERATION.

32. USING EARLY COMPUTERS, AN ACCOUNTING SYSTEM WAS DEVELOPED AND MADE AVAILABLE TO ALL BELL SYSTEM OPERATING COMPANIES BY THE YEAR_____.

33. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

34. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

35. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

36. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ CO.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

43. IT WAS APPARENT THAT A NEW THIRD GENERATION COMPUTER WOULD BECOME AVAILABLE BY THE YEAR _____.

44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

46. IN THE MID-1950'S, BELL LABORATORIES BEGAN A FEASIBILITY STUDY TO DEVELOP A SECOND GENERATION COMPUTER THAT WOULD TAKE OVER THE BILLING AND _____ JOB.

47. AFTER SEVERAL TRIALS THE PHOTAC COMPUTER WAS FOUND TO BE _____.

48. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD PROCESS PUNCHED CARDS _____ THAN BEFORE.

49. WHEN DATA PROCESSING WAS DONE MANUALLY, ACCOUNTANTS USED ADDRESSOGRAPH PLATES, CALCULATORS AND _____ MACHINES TO DO THE TASK OF CUSTOMER BILLING.

50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

28. mundane
    1-worldly
    2-obstinate
    3-deafening
    4-servile
    5-penniless

29. deleterious
    1-injurious
    2-hysterical
    3-critical
    4-slow
    5-thinned out

30. nascent
    1-colorful
    2-broad
    3-unpleasant
    4-floating
    5-beginning

31. prolific
    1-freely reproductive
    2-prehistoric
    3-talented
    4-highly temperamental
    5-frivolous

32. paroxysm
    1-bleach
    2-disaster
    3-storm
    4-fit
    5-revolution

33. antipodal
    1-outmoded
    2-slanted
    3-melodious
    4-opposite
    5-four-footed

34. acrimony
    1-promptness
    2-boredom
    3-divorce
    4-stupidity
    5-bitterness

35. lissome
    1-lonely
    2-young
    3-dreamy
    4-supple
    5-dainty

36. succinct
    1-sudden
    2-concise
    3-prosperous
    4-literary
    5-cunning

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

INVENTORY

PLEASE CIRCLE YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. 18 years or under
   2. 19-21 years
   3. 22-24 years
   4. 25 years or over

3. Were you familiar with the content of the lectures before participating in this experiment ?

   1. I knew most of the content prior to this experiment.
   2. I knew some of the content prior to this experiment.
   3. I knew very little of the content prior to this experiment.
   4. I knew none of the content prior to the experiment.

4. Did you find your participation in this experiment interesting ?

   1. very interesting
   2. somewhat interesting
   3. not very interesting
   4. not at all interesting

5. Were there sections of this experiment that you found confusing ?

   1. Yes (please explain below)
   2. No

_____

_____

_____

_____

Experimental Booklet for General After Treatment Group

DO NOT OPEN THIS BOOKLET

UNTIL YOU ARE INSTRUCTED TO DO SO

ABSTRACT

The passage you will hear is about data processing in the telephone industry. It deals with data processing prior to the development of computers, and discusses first, second, and third generation computers. How and why the computers were developed and their individual impacts on the progress of data processing in the telephone industry are considered. Comparisons among different computers with respect to the mechanics of operation, efficiency and effectiveness are also discussed. The telephone jobs that have been replaced by the use of computers are mentioned. By-products of system-wide efforts to improve data processing are included in the text of the passage.

Instructions

This is a test of your knowledge of word meanings. Look at the sample below. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

jovial
1-refreshing
2-scared
3-thickset
4-wise
5-jolly

The answer to the sample item is number 5; therefore, an X has been put through number 5.

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surtical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

Following this exercise the tape will read you a lecture of material. Liste carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 1.

Instructions

This page contains a "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

1. About data processing in the telephone industry prior to 1945.
2. About "AMA."
3. About the first generation large-scale computers.

Continue to re-read this List of Goals until the tape instructs you to stop.
Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

10. salubrious
    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid
    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate
    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete
    1-full
    2-elderly
    3-resentful
    4-discredited
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14. frieze
    1-fringe of curls on the forehead
    2-statue
    3-ornamental band
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    5-sherbet

15. treacle
    1-sewing machine
    2-framework
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    5-molasses

16. ignominious
    1-inflammable
    2-elflike
    3-unintelligent
    4-disgraceful
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17. abjure
    1-make certain
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    3-renounce
    4-abuse
    5-lose

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    1-period of time
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Following this exercise the tape will read you a lecture of material. List carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 2.

Instructions

This page contains another "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

4. What is meant by Mark Sensing and how it works.
5. About the development, creation, and use of the Operating Company accounting system and trunk estimating job.
6. How second generation computers accessed stored data and its mode of operation.

Continue to re-read this List of Goals until the tape instructs you to stop. Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

19. bayonet
    1-small tent
    2-basket
    3-helmet
    4-sharp weapon
    5-short gun

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    1-scold severely
    2-make angry
    3-surprise greatly
    4-drive out
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    1-contradiction
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22. amplify
    1-electrify
    2-expand
    3-cut off
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23. mural
    pertaining to
    1-growth
    2-manners
    3-the eyes
    4-war
    5-a wall

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    1-glad
    2-fortunate
    3-tall
    4-robust
    5-ready

25. meander
    1-marvel
    2-predict
    3-slope
    4-forget
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26. burnish
    1-polish
    2-wave
    3-dye
    4-heat
    5-consume

27. duplicity
    1-extent
    2-double-dealing
    3-agreement
    4-cleverness
    5-overlapping

Following this exercise the tape will read you a lecture of material. List carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 3.

Instructions

This page contains another "List of Goals" which you should have learned from the preceding lecture. This is a review of the important material.

List of Goals

7. About the Bell Laboratories (mid-1950's) feasibility study for computerizing the Billing and Collecting jobs.

8. About the full name and use of the New York Telephone Company computer called PHOTAC.

9. What other trials found about the ability of PHOTAC in handling customer service requests and the result.

Continue to re-read this List of Goals until the tape instructs you to stop.
Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

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    1-colorful
    2-broad
    3-unpleasant
    4-floating
    5-beginning

31. prolific
    1-freely reproductive
    2-prehistoric
    3-talented
    4-highly temperamental
    5-frivolous

32. paroxysm
    1-bleach
    2-disaster
    3-storm
    4-fit
    5-revolution

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    1-outmoded
    2-slanted
    3-melodious
    4-opposite
    5-four-footed

34. acrimony
    1-promptness
    2-boredom
    3-divorce
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    5-bitterness

35. lissome
    1-lonely
    2-young
    3-dreamy
    4-supple
    5-dainty

36. succinct
    1-sudden
    2-concise
    3-prosperous
    4-literary
    5-cunning

Following this exercise the tape will read you a lecture of material. Liste
carefully. You are to learn everything in the lecture.
Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 4.

Instructions

This page contains the final "List of Goals" which you should have learned from the preceding passage. This is a review of the important material.

List of Goals

10. One by-product of the system-wide effort using PHOTAC and what was gained.

11. What equipment is used to remotely operate third generation computers and why this is an advantage.

12. About the third generation computer's advantage of having a real time rather than a batch mode operation.

Continue to re-read this List of Goals until the tape instructs you to stop and begin the test. Do not turn this page until you are instructed to do so

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

DO NOT REFER TO ANY EARLIER PAGES IN THIS BOOKLET.

---

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
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22. THE THIRD GENERATION COMPUTER WOULD GREATLY EXPAND POTENTIAL _____ APPLICATIONS IN THE TELEPHONE INDUSTRY.

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25. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

26. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

27. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

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33. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

34. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

35. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

36. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ CO.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

43. IT WAS APPARENT THAT A NEW THIRD GENERATION COMPUTER WOULD BECOME AVAILABLE BY THE YEAR _____.

44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

46. IN THE MID-1950'S, BELL LABORATORIES BEGAN A FEASIBILITY STUDY TO DEVELOP A SECOND GENERATION COMPUTER THAT WOULD TAKE OVER THE BILLING AND _____ JOB.

47. AFTER SEVERAL TRIALS THE PHOTAC COMPUTER WAS FOUND TO BE _____.

48. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD PROCESS PUNCHED CARDS _____ THAN BEFORE.

49. WHEN DATA PROCESSING WAS DONE MANUALLY, ACCOUNTANTS USED ADDRESSOGRAPH PLATES, CALCULATORS AND _____ MACHINES TO DO THE TASK OF CUSTOMER BILLING.

50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP.

INVENTORY

PLEASE CIRCLE YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. 18 years or under
   2. 19-21 years
   3. 22-24 years
   4. 25 years or over

3. Were you familiar with the content of the lectures before participating in this experiment ?

   1. I knew most of the content prior to this experiment.
   2. I knew some of the content prior to this experiment.
   3. I knew very little of the content prior to this experiment.
   4. I knew none of the content prior to this experiment.

4. Did you find your participation in this experiment interesting?

   1. very interesting
   2. somewhat interesting
   3. not very interesting
   4. not at all interesting

5. Were there sections of this experiment that you found confusing?

   1. Yes (please explain below)
   2. No

_____

_____

_____

_____

Experimental Booklet for Control Group

DO NOT OPEN THIS BOOKLET

UNTIL YOU ARE INSTRUCTED TO DO SO

ABSTRACT

The passage you will hear is about data processing in the telephone industry. It deals with data processing prior to the development of computers, and discusses first, second, and third generation computers. How and why the computers were developed and their individual impacts on the progress of data processing in the telephone industry are considered. Comparisons among different computers with respect to the mechanics of operation, efficiency and effectiveness are also discussed. The telephone jobs that have been replaced by the use of computers are mentioned. By-products of system-wide efforts to improve data processing are included in the text of the passage.

Instructions

This is a test of your knowledge of word meanings. Look at the sample below. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

jovial
1-refreshing
2-scared
3-thickset
4-wise
5-jolly

The answer to the sample item is number 5; therefore, an X has been put through number 5.

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surtical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 1.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

1. nubile
   1-sexy
   2-rough
   3-intestinal
   4-artful
   5-rapid

2. impugn
   1-remove
   2-castigate
   3-assail
   4-deny
   5-authenticate

3. moniker
   1-optical
   2-nickname
   3-failure
   4-handkerchief
   5-shackle

4. resilient
   1-stiff
   2-bouncy
   3-frugal
   4-resistant
   5-resolute

5. riffle
   1-wave
   2-flag
   3-dance
   4-food
   5-illness

6. impede
   1-compete
   2-hinder
   3-hone
   4-crowd
   5-disembark

7. convivial
   1-enthusiastic
   2-ridiculous
   3-festive
   4-deadly
   5-insincere

8. concierge
   1-policeman
   2-arsonist
   3-bouquet
   4-doorkeeper
   5-hostess

9. conciliate
   1-vacillate
   2-boast
   3-unite
   4-congratulate
   5-destroy

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

10. hovel
    1-shed
    2-tool
    3-indigent
    4-book
    5-cafe

11. opus
    1-performance
    2-animal
    3-composition
    4-beginning
    5-aperture

12. raiment
    1-sunshine
    2-clothing
    3-golden
    4-meal
    5-remnant

13. sleight
    1-illusion
    2-lithe
    3-dexterity
    4-ignore
    5-clumsy

14. tryst
    1-meeting
    2-attempt
    3-failure
    4-truth
    5-poem

15. vacuity
    1-hollow
    2-yearly
    3-emptiness
    4-acridness
    5-desertion

16. munificent
    1-parsimonious
    2-bountiful
    3-beautiful
    4-public
    5-fastidious

17. inadvertent
    1-intentional
    2-unavoidable
    3-negligent
    4-unexpected
    5-negotiable

18. gnomic
    1-elfin
    2-pithy
    3-enormous
    4-potent
    5-chronic

Following this exercise the tape will read you a lecture of material. Liste
carefully. You are to learn everything in the lecture.
Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 2.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

10. salubrious
    1-mirthful
    2-indecent
    3-salty
    4-mournful
    5-healthful

11. limpid
    1-lazy
    2-crippled
    3-clear
    4-hot
    5-slippery

12. procreate
    1-sketch
    2-inhabit
    3-imitate
    4-beget
    5-encourage

13. replete
    1-full
    2-elderly
    3-resentful
    4-discredited
    5-restful

14. frieze
    1-fringe of curls on the forehead
    2-statue
    3-ornamental band
    4-embroidery
    5-sherbet

15. treacle
    1-sewing machine
    2-framework
    3-leak
    4-apple butter
    5-molasses

16. ignominious
    1-inflammable
    2-elflike
    3-unintelligent
    4-disgraceful
    5-mysterious

17. abjure
    1-make certain
    2-arrest
    3-renounce
    4-abuse
    5-lose

18. duress
    1-period of time
    2-distaste
    3-courage
    4-hardness
    5-compulsion

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number of the word that you select.

19. bayonet
    1-small tent
    2-basket
    3-helmet
    4-sharp weapon
    5-short gun

20. astound
    1-scold severely
    2-make angry
    3-surprise greatly
    4-drive out
    5-ascertain

21. contamination
    1-contradiction
    2-contempt
    3-warning
    4-pollution
    5-continuation

22. amplify
    1-electrify
    2-expand
    3-cut off
    4-signify
    5-supply

23. mural
    pertaining to
    1-growth
    2-manners
    3-the eyes
    4-war
    5-a wall

24. hale
    1-glad
    2-fortunate
    3-tall
    4-robust
    5-ready

25. meander
    1-marvel
    2-predict
    3-slope
    4-forget
    5-wind

26. burnish
    1-polish
    2-wave
    3-dye
    4-heat
    5-consume

27. duplicity
    1-extent
    2-double-dealing
    3-agreement
    4-cleverness
    5-overlapping

Following this exercise the tape will read you a lecture of material. Liste carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 3.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

19. fulminate
    1-ignite
    2-aerate
    3-detonate
    4-culminate
    5-situate

20. eradicate
    1-erase
    2-embossed
    3-radiate
    4-fumigate
    5-organize

21. deride
    1-extol
    2-ridicule
    3-deny
    4-determine
    5-ignore

22. commodious
    1-sparse
    2-spacious
    3-uproarious
    4-artificial
    5-motherly

23. coffer
    1-tomb
    2-strongbox
    3-deacon
    4-stream
    5-parlor

24. chortle
    1-wheeze
    2-chuckle
    3-whisper
    4-instrument
    5-device

25. cauterize
    1-freeze
    2-solder
    3-burn
    4-warn
    5-chastise

26. candid
    1-bottled
    2-frank
    3-dishonest
    4-expected
    5-frightened

27. charisma
    1-presence
    2-luminous
    3-charm
    4-honesty
    5-sobriety

Continue to work on this exercise until the the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

28. larch
    1-conflict
    2-pine tree
    3-mountain
    4-beggar
    5-jump

29. dyspeptic
    1-iconoclastic
    2-ornery
    3-gloomy
    4-distinct
    5-disoriented

30. numismatist
    1-mathematician
    2-coin studier
    3-exhibitionist
    4-stamp collector
    5-benefactor

31. rife
    1-chaotic
    2-bountiful
    3-dreamy
    4-angered
    5-overjoyed

32. sedition
    1-partition
    2-alienation
    3-rebellion
    4-suspicion
    5-position

33. seine
    1-strait
    2-trout
    3-fishnet
    4-necklace
    5-seam

34. wherry
    1-cautious
    2-belligerent
    3-rowboat
    4-alcohol
    5-ill

35. yeoman
    1-factotum
    2-manservant
    3-shepherd
    4-gardener
    5-sailor

36. zephyr
    1-dirigible
    2-instrument
    3-wildlife
    4-breeze
    5-current

Following this exercise the tape will read you a lecture of material. Listen carefully. You are to learn everything in the lecture.

Do not turn this page until you are instructed to do so.

YOU SHOULD HAVE YOUR BOOKLET OPEN TO THIS PAGE WHILE THE TAPE IS READING LECTURE SECTION 4.

QUESTIONS

ANSWER ALL QUESTIONS EVEN IF YOU MUST GUESS. PRINT OR WRITE CLEARLY.

DO NOT REFER TO ANY EARLIER PAGES IN THIS BOOKLET.

1. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE SORTED AND SUMMARIZED WITH EQUIPMENT THAT OPERATED _____.
2. IN THE MARK SENSING PROCESS, CARDS WERE READ AND PUNCHED _____.
3. BATCH PROCESSING IN EARLY COMPUTERS REQUIRED THAT WORK OF A _____ NATURE BE DONE FIRST AND THEN TAKEN AWAY SO THAT THE NEXT BATCH COULD BE PROCESSED.
4. MACHINES USING _____ OCCUPY LESS FLOOR SPACE THAN THOSE USING VACUUM TUBES.
5. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DONE BY PEOPLE FROM THE _____ CO.
6. THE ABBREVIATION AMA STANDS FOR _____ _____ _____.
7. HISTORICALLY, THE AMA SYSTEM WAS IMPORTANT BECAUSE IT WAS THE FORERUNNER OF MODERN ELECTRONIC _____ SYSTEMS.
8. USING EARLY COMPUTERS, DEVELOPMENTAL WORK AIMED AT CREATING AN ACCOUNTING SYSTEM WAS PERFORMED BY OPERATING COMPANIES UNDER THE GUIDANCE OF THE _____ CO.
9. DATA PROCESSING IN THE TELEPHONE INDUSTRY WAS ON A MANUAL BASIS PRIOR TO THE YEAR _____.
10. SECOND GENERATION COMPUTERS STILL OPERATED IN A _____ MODE.
11. THE MEMORY OF THE FIRST GENERATION COMPUTERS WAS STORED ON PAPER AND _____ TAPE.

12. THE PHOTAC COMPUTER IS NOW USED AS THE BASIS FOR A _____ UNDER DEVELOPMENT.
13. THIRD GENERATION COMPUTERS CAN RETRIEVE INFORMATION ON _____.
14. FIRST GENERATION COMPUTER'S DATA HAD TO BE PROCESSED AND RETRIEVED _____.
15. LARGE SCALE DIGITAL COMPUTERS FOR BUSINESS APPLICATIONS MADE THEIR FIRST APPEARANCE BETWEEN THE YEARS _____ AND 1954.
16. THIRD GENERATION COMPUTERS USE INPUT-OUTPUT DEVICES SUCH AS CATHODE RAY TUBES (CRT'S) AND _____.
17. IN TERMS OF SIZE, THE TRANSISTOR IS _____ THAN THE VACUUM TUBE.
18. COMPARED TO TODAY'S COMPUTERS, FIRST GENERATION COMPUTERS WERE VERY _____.
19. THIRD GENERATION COMPUTERS ARE CAPABLE OF OPERATING ON _____ SIMILAR TO THE HANDLING OF DIRECT DISTANCE DIALED CALLS.
20. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD NOW PERFORM _____ IN ADDITION TC SORTING, SUMMARIZING, AND PRINTING RESULTS.
21. WITH THE INTRODUCTION OF THIRD GENERATION COMPUTERS, MANUFACTURERS BEGAN TO PROVIDE MORE TECHNICAL SUPPORT IN THE FORM OF PROGRAMS OR _____.
22. THE THIRD GENERATION COMPUTER WOULD GREATLY EXPAND POTENTIAL _____ APPLICATIONS IN THE TELEPHONE INDUSTRY.
23. THE MOST IMPORTANT ADVANTAGE OF THIRD GENERATION COMPUTERS IS THAT THEY ARE NO LONGER RESTRICTED TO A BATCH MODE OF OPERATION AT _____ LOCATION.

24. THE PEOPLE WHO PARTICIPATED IN THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WERE ABLE TO PURSUE NEW DATA PROCESSING GOALS ON A MORE _____ BASIS THAN WAS PREVIOUSLY POSSIBLE.

25. THE FIRST GENERATION COMPUTER'S DATA COULD NOT BE ACCESSED _____ OR IN A RANDOM MANNER.

26. THE FIRST GENERATION COMPUTERS USED BANKS OF _____.

27. ONE BY-PRODUCT OF THE SYSTEM-WIDE EFFORT TO EXPLORE WAYS OF USING SECOND GENERATION COMPUTERS WAS THE STORING UP OF A VAST RESERVOIR OF ELECTRONIC DATA PROCESSING _____.

28. PUNCHED CARDS WERE ORIGINALLY KNOWN AS _____ CARDS.

29. THE AMA SYSTEM WAS USED FOR _____ PURPOSES.

30. THE MID-1950'S BELL LABORATORIES FEASIBILITY STUDY WAS DISCONTINUED WHEN IT BECAME APPARENT THAT _____ COMPUTERS COULD DO THE JOB.

31. THE NEW YORK TELEPHONE CO. COMPUTER, PHOTAC, WAS USED TO COMPUTERIZE A _____ OPERATION.

32. USING EARLY COMPUTERS, AN ACCOUNTING SYSTEM WAS DEVELOPED AND MADE AVAILABLE TO ALL BELL SYSTEM OPERATING COMPANIES BY THE YEAR_____.

33. MARK SENSING IS DONE BY MARKING LETTERS AND DIGITS WITH _____ STROKES ON BLANK PUNCHED CARDS.

34. FIRST GENERATION COMPUTERS REQUIRED "BATCH PROCESSING" AS THE MODE OF OPERATION BECAUSE THEIR MEMORY WAS ON PAPER AND _____ TAPE.

35. WHEN DATA PROCESSING WAS DONE MANUALLY, PUNCHED CARDS WERE USED IN THE AREAS OF MAINTENANCE OF PROPERTY RECORDS AND _____ ACCOUNTING.

36. THIRD GENERATION COMPUTERS USE A _____ TIME OPERATION RATHER THAN A BATCH MODE OPERATION.

37. ONE ADVANTAGE OF THE THIRD GENERATION COMPUTER INPUT-OUTPUT DEVICES IS THAT WORK CAN BE FED IN AND RETURNED FROM A _____.

38. THE THIRD GENERATION COMPUTER, COMPARED TO THE SECOND GENERATION COMPUTER, WAS A FAR MORE _____ SYSTEM.

39. THE LEAST EFFECTIVE PART OF THE PHOTAC COMPUTER WAS IN GIVING _____ RESPONSE TO CUSTOMER SERVICE REQUESTS.

40. TRANSISTORS ARE MORE EFFICIENT BECAUSE THEY OPERATE _____, THEREBY ELIMINATING THE NEED FOR FREQUENT REPLACEMENT.

41. EVEN THOUGH THE MID-1950'S FEASIBILITY STUDY WAS DISCONTINUED, A SYSTEM-WIDE EFFORT TO EXPLORE WAYS TO USE COMPUTERS WAS UNDERTAKEN BY THE _____ CO.

42. IN ORDER TO EXPLORE WAYS TO USE SECOND GENERATION COMPUTERS, BELL SYSTEM OPERATIONS WERE GROUPED INTO _____ MAJOR FIELDS WHICH WERE CONSIDERED GOOD CANDIDATES.

43. IT WAS APPARENT THAT A NEW THIRD GENERATION COMPUTER WOULD BECOME AVAILABLE BY THE YEAR _____.

44. FIRST GENERATION COMPUTERS WERE USED FOR AN EXTENSIVE TRUNK ESTIMATING JOB IN WHICH A _____ COMPUTER WAS USED.

45. SECOND GENERATION COMPUTERS POSSESSED A COMPACT MEMORY WHICH PERMITTED _____ ACCESS TO ANY PART OF THE STORAGE AREA.

46. IN THE MID-1950'S, BELL LABORATORIES BEGAN A FEASIBILITY STUDY TO DEVELOP A SECOND GENERATION COMPUTER THAT WOULD TAKE OVER THE BILLING AND _____ JOB.

47. AFTER SEVERAL TRIALS THE PHOTAC COMPUTER WAS FOUND TO BE _____.

48. THE TECHNOLOGY OF WORLD WAR II BROUGHT A NEW LINE OF MACHINERY INTO BEING WHICH COULD PROCESS PUNCHED CARDS _____ THAN BEFORE.

49. WHEN DATA PROCESSING WAS DONE MANUALLY, ACCOUNTANTS USED ADDRESSOGRAPH PLATES, CALCULATORS AND _____ MACHINES TO DO THE TASK OF CUSTOMER BILLING.

50. THE TRANSISTOR IS MORE _____ THAN THE VACUUM TUBE.

51. THE TRANSISTOR WAS INVENTED AT BELL LABORATORIES IN THE YEAR _____.

52. FOLLOWING THE DEVELOPMENT OF THE ACCOUNTING SYSTEM USING EARLY COMPUTERS, OTHER JOBS WERE COMPUTERIZED SUCH AS PROCESSING _____.

KEEP WORKING ON THIS TEST UNTIL THE TAPE TELLS YOU TO STOP.

Instructions

This is a test of your knowledge of word meanings. One of the five numbered words has the same meaning or nearly the same meaning as the word above the numbered words. Mark your answer by putting an X through the number in front of the word that you select.

28. mundane
    1-worldly
    2-obstinate
    3-deafening
    4-servile
    5-penniless

29. deleterious
    1-injurious
    2-hysterical
    3-critical
    4-slow
    5-thinned out

30. nascent
    1-colorful
    2-broad
    3-unpleasant
    4-floating
    5-beginning

31. prolific
    1-freely reproductive
    2-prehistoric
    3-talented
    4-highly temperamental
    5-frivolous

32. paroxysm
    1-bleach
    2-disaster
    3-storm
    4-fit
    5-revolution

33. antipodal
    1-outmoded
    2-slanted
    3-melodious
    4-opposite
    5-four-footed

34. acrimony
    1-promptness
    2-boredom
    3-divorce
    4-stupidity
    5-bitterness

35. lissome
    1-lonely
    2-young
    3-dreamy
    4-supple
    5-dainty

36. succinct
    1-sudden
    2-concise
    3-prosperous
    4-literary
    5-cunning

Continue to work on this exercise until the tape instructs you to stop.

Do not turn this page until you are instructed to do so.

INVENTORY

PLEASE CIRCLE YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. 18 years or under
   2. 19-21 years
   3. 22-24 years
   4. 25 years or over

3. Were you familiar with the content of the lectures before particiapting in this experiment ?

   1. I knew most of the content prior to this experiment.
   2. I knew some of the content prior to this experiment.
   3. I knew very little of the content prior to this experiment.
   4. I knew none of the content prior to this experiment.

4. Did you find your participation in this experiment interesting ?

   1. very interesting
   2. somewhat interesting
   3. not very interesting
   4. not at all interesting

5. Were there sections of this experiment that you found confusing ?

   1. Yes (please explain below)
   2. No

_____

_____

_____

_____

APPENDIX G

Answer Keys

Answer Key for Criterion Test

1. electromechanically, electrically
2. mechanically, by machine
3. similar, like
4. transistors
5. Operating
6. Automated Message Accounting
7. computer, computing
8. A. T. & T, telephone
9. 1945
10. batch
11. magnet, magnetic
12. subsystem, sub-unit
13. command, demand, on call
14. sequentially, in sequence, serially, in recording order
15. 1945
16. teletypewriters, teletypes
17. smaller
18. plan, inefficient, large, primitive
19. call, command, demand
20. +, -, x, ÷, calculations, math, arithmetic
21. software
22. service
23. a single one; a specific, a certain
24. effective, professional, efficient, advanced

25. directly

26. vacuum tubes

27. methods, expertise, experience, knowledge, skills, technology

28. Hollerith

29. charging, billing, accounting

30. commercial, outside, manufactured

31. typesetting, printing, listing

32. 1954

33. lead, pencil

34. magnet, magnetic

35. financial, cost, business

36. real

37. distance, place other than immediate location

38. flexible, versatile, advanced, efficient

39. quick, immediate, instant, rapid, prompt, fast

40. cool, cooler, cold, without heat

41. A. T. & T.

42. 15

43. 1963

44. Univac

45. direct

46. collection, accounting

47. not good enough, faulty, unreliable, inefficient, inadequate, not feasible

48. bookkeeping

49. bookkeeping

50. compact, effective, rugged, efficient, reliable, durable

51. 1948

52. payrolls

Vocabulary Answer Key

1.	1 - speak indistinctly	10.	5 - healthful
2.	2 - sweat	11.	3 - clear
3.	2 - spout	12.	4 - beget
4.	4 - huge and solid	13.	1 - full
5.	1 - pretend	14.	3 - ornamental band
6.	3 - incautious	15.	5 - molasses
7.	1 - change direction	16.	4 - disgraceful
8.	1 - conventional	17.	3 - renounce
9.	4 - lad	18.	4 - hardness
19.	4 - sharp weapon	28.	1 - worldly
20.	3 - surprise greatly	29.	1 - injurious
21.	4 - pollution	30.	5 - beginning
22.	2 - expand	31.	1 - freely reproductive
23.	5 - a wall	32.	4 - fit
24.	4 - robust	33.	4 - opposite
25.	5 - wind	34.	5 - bitterness
26.	1 - polish	35.	4 - supple
27.	2 - double-dealing	36.	2 - concise

APPENDIX H

Analysis of Variance Tables

Multivariate Analysis of Covariance

2(position) X 2(specificity)

Dependent Variables: Intentional learning

Incidental learning

Covariate: Vocabulary score

Specificity: Multivariate F = 1.54

df 2/122

$p < .21$

Position: Multivariate F = 5.84

df 2/122

$p < .003$

Variable	Univariate F	p less than	df
intentional	11.61	.0009	1/123
incidental	1.06	.3043	1/123

Interaction: (Position X Specificity)

Multivariate F = .034

df: 2/122

$p < .96$

Multivariate Analysis of Covariance

5(groups) X 2(learning)

Dependent variables: Intentional learning

Incidental learning

Covariate: Vocabulary score

Groups: Multivariate F = 3.97

df: 8/306

$p < .0002$

Variable	Univariate F	p less than	df
intentional	7.34	.0001	4/154
incidental	3.40	.0108	4/154

Univariate Analysis of Variance

2(position) X 2(specificity) X 2(learning)

Source of Variance	Sum of Squares	Degrees Freedom	Mean Square	F
Specificity (S)	417.69	1	417.69	1.758
Position (P)	609.47	1	609.47	2.565
Learning (L)	543.47	1	543.47	7.618*
S x P	11.82	1	11.82	<1
S x L	10.16	1	10.16	<1
P x L	230.66	1	230.66	3.233
Subjects/(SP)	29461.23	124	237.59	-
S x P x L	1.722	1	1.722	<1
Subjects x Learning/SP	8845.48	124	71.33	-

N = 128 *$p < .01$

Univariate Analysis of Variance

5(groups) X 2(learning)

Source of Variance	Sum of Squares	Degrees Freedom	Mean Square	F
Group (G)	4481.01	4	1120.25	4.426*
Learning (L)	585.90	1	585.90	8.709*
Subjects/G	39232.98	155	253.12	-
G x L	256.36	4	64.09	1
(Subjects x L)/G	10427.23	155	67.27	-

N = 160 *p < .01

APPENDIX I

Table of Means and Standard Deviations

TABLE OF MEANS AND STANDARD DEVIATIONS

LEARNING SCORES: MEAN PERCENTAGE RECALLED

Learning		SB	SA	GB	GA	C
Intentional:	Mean	36.31	31.59	39.53	34.28	27.75
	St. dev.	10.69	10.96	11.18	10.09	12.14
Incidental:	Mean	37.56	36.97	40.31	38.53	29.63
	St. dev.	14.25	14.33	14.08	12.92	14.79
Total:	Mean	36.94	34.28	39.92	36.41	29.63
	St. dev.	9.07	11.47	11.22	9.90	12.24

N=160